METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

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MALCOLM RIGBY, Editor

Volume 4, 1953

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Bibliography on Statistical Theory of Turbulence

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January, 1953 No. 1

METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

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***EDITORIAL OFFICE:** Washington, D. C. **P.O. ADDRESS:** Box 1736, Washington 13, D. C. Telephone: REpublic 7–6278.

ADMINISTRATIVE OFFICE: American Meteorological Society, Office of Executive Secretary, 3 Joy Street, Boston 8, Mass.

* Address all business communications, orders and inquiries to the Executive Secretary, Mr. Kenneth C. Spengler, 3 Joy Street, Boston 8, Mass. Exchanges and reprints may be sent direct to P. O. Box 1736, Washington 13, D. C.

METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY is a monthly publication devoted to:

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METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

MALCOLM RIGBY, Editor

Vol. 4 JANUARY 1953 No. 1

SPECIAL FEATURE IN THIS ISSUE

A Selective Annotated Bibliography on the Statistical Theory of Turbulence

(For complete table of contents see back cover)

Published monthly at Prince and Lemon Streets, Lancaster, Pa., by the AMERICAN METEOROLOGICAL SOCIETY, 3 Joy Street, Boston 8, Mass.

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The commonwealth of learning is not at this time without master-builders, whose mighty designs, in advancing the sciences, will leave lasting monuments to the admiration of posterity: but everyone must not hope to be a Boyle or a Sydenham; and in an age that produces such masters as the great Huygenius and the incomparable Mr. Newton, with some others of that strain, it is ambition enough to be employed as an under-labourer in clearing the ground a little, and removing some of the rubbish that lies in the way of knowledge; which certainly had been very much more advanced in the world, if the endeavours of ingenious and industrious men had not been much cumbered with the learned but frivolous use of uncouth, affected, or unintelligible terms, introduced into the sciences, and there made an art of, . . .

JOHN LOCKE: **An Essay Concerning Human Understanding** 1690

EDITORIAL

Confusion in terminology is, even today, the biggest stumbling block in the way to the advancement of knowledge. Since the amount of literature in any developing field is doubling every 15 or 20 years, it is becoming increasingly difficult if not hopeless to locate an article or a number of articles on any given subject. Thus a great deal of thought and effort must be given to clearing away, or making order out of this rubbish of terminology that we are "stuck with."

The chemists and biologists have a bigger problem than do the meteorologists since they must deal with popular terms, scientific terms, formulas and even graphic (ring) symbols, all of which must be systematically indexed in any field where over 50,000 articles are published each year. But the major efforts in systematizing these fields were made 30 to 50 years ago, whereas the systematization of terminology in Meteorology is forced on us now, at the time of the most rapid expansion in meteorological activity in history.

Of course the efforts made in the past 20 years by C. E. P. Brooks and others to systematize the *concepts* in the field of meteorology, through elaboration of the Decimal Classification System for Meteorology (551.5), have been of tremendous value in making order out of the interlingual chaos of terminology. This system has been used consistently and it is hoped accurately in *Meteorological Abstracts*, thanks to the constant collaboration of Dr. C. E. P. Brooks (who receives all proofs by air mail at his home in Ferring, England, corrects them, and returns the corrections so that we receive them within one week of the date of receipt from the printer). This excellent international collaboration is, naturally, of the greatest benefit to libraries and to Meteorologists in foreign countries where the U.D.C. system is in common use.

A recent criticism (from Australia) of the lack of conformity of the Subject Headings used in *Meteorological Abstracts* with the U.D.C. numbers assigned in one given field 551.511 (Mechanics and Thermodynamics of the Atmosphere), nicely illustrates the usefulness of Subject Headings in such fields as Dynamic Meteorology or Bioclimatology where new concepts or expressions are constantly appearing in the literature. If there were 100% or even 90% conformity between UDC numbers and Subject Headings, one or the other could and should be dropped. For international usage and for libraries U.D.C. numbers would be preferable. For the research worker, who has not become familiar with the details of U.D.C., Subject Headings provide a more workable tool.

The main value of the Subject Heading lies in its greater flexibility. New or modified terms can be assigned at will and used in indexing, or guide cards can be prepared in a few moments for filing in a private file. In a special library Subject Headings, with slight alteration, could be used to subdivide a field such as 551.511 without waiting out the 2 to 10 years period which ordinarily elapses before new numbers can be assigned and approved by all the international bodies concerned.

Thus the Subject Heading, though more ambiguous and less systematic than the Decimal Index, serves a useful and indispensible purpose by allowing an index to be detailed, up-to-date, idiomatic and flexible to a greater degree than does the classed system. Furthermore it can contribute greatly to the future systematic subdivision of fields like Dynamic Meteorology, Micrometeorology, Bioclimatology, Turbulence, etc. In order to accomplish its maximum value, however, a great deal of thought must be given to cross referencing, paring away useless terms and collating redundant expressions. One would be presumptuous to hope to do for the confusion in meteorological terminology what John Locke did for Natural Philosophy, but the challenge is as great, for our rapidly expanding field is as broad and chaotic as Philosophy was in the 17th century.—*M.R.*

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The Missing Pages In This Volume Are Advertisements

FOREWORD

Meteorological Abstracts and Bibliography is a monthly publication whose purpose is to bring to the attention of meteorologists current literature in their field and in related fields and to provide bibliographic information on various subjects, as interest demands.

Part I contains from 175 to 300 abstracts of current periodical literature and monographs in the fields of meteorology, hydrology, oceanography, etc. These abstracts are arranged according to the Universal Decimal Classification.

Part II of each issue comprises a special annotated bibliography of from 50 to 250 important references on a special subject without respect to recency of material. No attempt is made to prepare exhaustive bibliographies; instead, the aim is to include a representative cross section of the various aspects of a subject. Preference is given to recent material, comprehensive works, material from obscure sources, and items with good bibliographies.

Bibliographies previously published were:

No.	Mo.	Vol. I, 1950	Vol. II, 1951	Vol. III, 1952
1.	Jan.	**Atmospheric Pollution**	**Extended Forecasting**	**Climate—Northwest Africa**
2.	Feb.	**Aerobiology**	**Long Range Forecasting**	**Carbon Dioxide**
3.	March	**Cloud Physics**	**Soil Temperature**	**Climate—Paraguay, Uruguay, Argentina**
4.	April	**Hail**	**Constants, Tables, Diagrams**	**Dew**
5.	May	**Tornadoes**	**Climate—Near East**	**Objective Forecasting**
6.	June	**Volcanic Dust**	**Climate—Middle East**	**Stratus Forecasting**
7.	July	**Climatic Changes**	**Special Winds**	**Urban Climatology**
8.	Aug.	**Thunderstorms**	**Radar Storm Detection**	**Climate—Central Africa**
9.	Sept.	**Icing**	**Condensation Trails**	**Visibility**
0.	Oct.	**Acoustical Propagation**	**Climate—Northeast Africa**	**Glaze and Rime**
1.	Nov.	**Evaporation**	**Mountain Meteorology**	**Free Air Turbulence**

Forthcoming bibliographies will be:

1. **Turbulence Theory,** Vol. IV, No. 1, Jan. 1953
2. **Turbulent Diffusion and Exchange,** Vol. IV, No. 2, Feb. 1953
3. **Frost and Frost Forecasting,** Vol. IV, No. 3, March 1953

Other bibliographies in preparation are:

Actinometers
Arctic Meteorology
Auroral Physics
Climate of Australasia
Climate of Southeast Asia and the East Indies
Climate of the Pacific Ocean Area
High Level Winds
Radiation Bioclimatology
Machine Methods in Meteorology
Microwave Propagation
Oceanographic Meteorology
Ozone
Snow Cover
Tropical Cyclones
Tropopause Variations

Part III contains a listing of the contents of those journals which are primarily meteorological. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes. In the June and December issues cumulative indexes are published.

EXPLANATIONS

Location of material: For each entry, a symbol is given for at least one library where the material may be found. The Union List of Serials (Gregory) is the source of most of the symbols used. In some cases, where no symbol has been assigned to a library, one will be devised according to the principles of the Union List.

Library symbols used frequently may be found in the following list:

DA:	U. S. Dept. of Agriculture Library, Washington, D. C.
DBS:	U. S. Bureau of Standards Library, Washington, D. C.
DGS:	U. S. Geological Survey Library, Washington, D. C.
DLC:	Library of Congress, Washington, D. C.
DSG:	U. S. Army Medical Library, Washington, D. C.
DSI:	Smithsonian Institution Library, Washington, D. C.
DWB:	U. S. Weather Bureau Library, Washington, D. C.
GB-MO:	Great Britain, Meteorological Office Library, Harrow, England.
MH-BH:	Harvard University, Blue Hill Observatory (and American Meteorological Society) Library, Milton, Mass.
NN:	New York Public Library, New York, N. Y.
NNA:	American Geographical Society Library, New York, N. Y.

Other symbols:

*	before an entry indicates a good data source.
†	before an entry indicates a good bibliography.
§	before an entry indicates a synoptic case history study accompanied by charts

Geographic locations are in the English form rather than the form used locally, for example Moscow for Moskva.

Titles of articles or monographs are in the language of the original article unless otherwise stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet according to the Library of Congress transliteration scheme.

Abbreviations:

Titles of periodicals are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months are abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Number (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus an entry will read as follows:

Meteorologische Rundschau, 2(5–6):146–151, May–June 1950.

This indicates that the article appeared in *Meteorologische Rundschau, Jahrgang* 2 (Vol. 2), *Heft* 5–6 (No. 5 and 6), *pages* 146–151, May–June 1950.

PART I. ABSTRACTS OF CURRENT METEOROLOGICAL MATERIAL

COMPENDIUM ARTICLES AND WORKS OF SPECIAL INTEREST

4.1–1 551.577.11:551.510.41

*Ångström, Anders and Högberg, Linus, (*Swedish Met. and Hydro. Inst.*), **On the content of nitrogen (NH_4-N, and NO_3-N) in atmospheric precipitation.** *Tellus*, 4(1):31–42, Feb. 1952. 4 figs., 14 tables, 2 refs. **MH-BH**—Samples of precipitation taken between Oct. 1, 1947 and Sept. 30, 1950 at the Agricultural College at Ultuna, Sweden (59°49′ and 17°40′E) were analyzed for NH_4-N and NO_3-N by the use of ion-exchange resins. Immediate filtering and other special arrangements were made to eliminate errors from contamination by pollen, insects, etc. A marked dependence on duration of rain or snow was noted from analysis of 117 cases. Frequency tables seem to give relationship: $S=\alpha \log(1-P)$ where P is amount of precipitation up to moment of S, α is a constant and S is total amount of NH_4-N or NO_3-N, in Kg per hectare. The concentration σ at the moment when a specified amount N has fallen is: $\sigma=100\cdot\frac{ds}{dp}=\frac{100\alpha}{1-P}$. It can be seen that σ decreases rapidly with increase in P. This seems to be due to a "washing out" process in the atmosphere. By using data for 117 cases sampled, an estimate is made of total amount of nitrogen for all of the 190 cases which occurred in that period, yielding a total of 3.22 kg per ha for NH_4-N, and 1.54 kg/ha for NO_3-N, or an average annual amount of 1.90 and 0.91 kg/ha respectively. An analysis of thunderstorm cases didn't prove anything, but analysis by air masses showed NH_4-N values of coefficient α of .0354 for Tropical air, .0262 for Polar air and .0172 for Arctic air and NO_3-N values of .0142, .0131 and .0094 respectively for the air masses of the 3 types. Since Arctic air has only 50% as much N as Tropical it is concluded that precipitation in northern Sweden would have less than in southern Sweden or in subtropics. The almost constant ratio of 2:1 for NH_4-N and NO_3-N suggests a common origin—perhaps nuclei such as pollen or dust from earth's surface. Whether the amount reaches zero, or an asymptotically decreasing value which never reaches zero, is not yet determined. The report contains elaborate contingency tables and graphs for concentrations under varying conditions cited above. *Subject Headings:* **1. Precipitation analysis 2. Nitrogen content of precipitation 3. Ultuna, Sweden.**—*M.R.*

4.1–2 551.509.31:551.576

†Brooks, Charles Franklin (*Blue Hill Met. Obs., Harvard Univ.*), **The use of clouds in forecasting.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, 1951. p. 1167–1178. 9 tables, 102 refs.) **MH-BH**—Various methods of cloud observing—determining levels, extents, position, heights and motions—such as range-finder and dew point methods, the nephoscope and cloud range meter of radar type are reviewed briefly. The author gives a detailed survey of the use of clouds in short term forecasting at a single station, such as the relationship of daily variation of cloud type to weather change, trends in transformation of cloud types as an indication of rain; halos before rain; double cirrus as an indication of bad weather; undulated sheet clouds as forerunners of warmer weather and rain; mammatus clouds as indicators of precipitation; altocumulus and rain; altocumulus lenticularis as a sign of wet weather; cirronimbus and fine weather; the prognostics of the directions of cloud motion; motions of cirrus as prognostics of movements of cyclones; cloud motions and shapes as indicators of wind, wind shear, vertical currents and turbulence; altocumulus direction and speed and thunderstorm movement; and the indication of wind shift line by clouds. Also the use of synoptic cloud data in weather forecasting is discussed. The development of cloud synoptics since Ley (1872) and examples of its use, various studies on cloud cross sections,

the use of synoptically mapped clouds to indicate intensification of a low before a trend is observed in isobars or surface winds, and the use of clouds to indicate the masses in which an approaching low will pass a station are summarized. *Subject Headings:* **1. Clouds 2. Short range forecasting 3. Compendium articles.**—*I.L.D.*

4.1–3 551.508:551.501:551.551(02)

†Gol'tsman, M. I., **Osnovy metodiki aerofizicheskikh izmerenii.** [Fundamentals of methodology of aerophysical measurements.] Moscow, Gosizdat., **1950.** 360 p. 79 figs., 23 tables, 121 refs., eqs. **DLC**—This textbook is one of the most important works on meteorological instruments published during the past decade. Beginning with the theory of atmospheric turbulence, representativeness of observations, and accuracy of measurements due to the turbulent structure of the atmosphere as well as to instrumental characteristics, the author takes up in separate chapters the structure or nature of each of the important meteorological elements (temperature, humidity, pressure and wind), and the factors influencing the accuracy of instruments commonly used to measure each of these elements. The superiority of the performance of the resistance thermometer (platinum wire) over that of the conventional psychrometer is due to the small lag (quick response) and to nondependence of readings on solar radiation or on ventilation. True air temperature can thus be measured for instant conditions or averaged over 2–3 minutes. Errors in shelters amount to 1°C or 10% relative humidity whichever system is used. Curves showing probable distribution of errors and actual readings are presented for each type of instrument. A number of original instruments for measuring micrometeorological elements are described and illustrated. The appendix (p. 346–354) discusses the measurement of vertical temperature, humidity and wind gradients. A long chapter (115 pages) devoted to wind measurements takes up measurement of horizontal and vertical velocities and includes several new vertical velocity instruments developed at the Central Geophysical Observatory in Leningrad. The extensive list of references is not limited to Soviet works. *Subject Headings:* **1. Turbulence measurement 2. Micrometeorological instruments 3. Instrument accuracy 4. Micro-oscillations 5. Textbooks.**—*A.A., M.R.*

4.1–4 551.511:551.515

†Hollmann, Günther, **Zur Dynamik stationärer atmosphärischer Druckfelder.** [On the dynamics of stationary atmospheric pressure fields.] *Germany. Deutsche Demokratische Republik, Meteorologischer Dienst, Abhandlungen*, Nr. 12, **1952.** 32 p. 5 figs., 2 tables, 47 refs., 97 eqs. **DWB**—This monograph investigates the dynamic conditions in which a stationary pressure field can exist with a cellular structure at the surface. In the absence of friction, cells in a barotropic atmosphere move westward, unless a sufficient meridional pressure gradient (due to a temperature gradient) is superposed, as is usually the case. This may be important for extended forecasting. The cellular surface pattern corresponds to an upper wave pattern, including vertical motion which changes sign at a given level. In Pt. 2 friction is introduced. The new differential equation requires a westward inclination of the cell axis, in accordance with experience. At the surface, air flows out of a high on all sides and the resulting upper convergence causes the anticyclonic curvature to become cyclonic. *Subject Headings:* **1. Dynamics of the atmosphere 2. Stationary perturbations.**—*C.E.P.B.*

4.1–5 551.511:551.524.4:551.526.6

†Jacobs, Woodrow Cooper (*U. S. Air Weather Service, Wash., D. C.*), **Large-scale aspects of energy transformation over the oceans.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 1057–1070. 5 figs., 8 tables, 41 refs.) **MH-BH**—A very comprehensive and clear account of the "large scale and more or less long-term (average) aspects of the *convective* transfer of energy between sea surface and atmosphere." The discussion covers (1) the rate of exchange of sensible heat between sea surface and atmosphere, (2) the rate of exchange of energy in the latent form of water vapor, (3) the rate of total heat loss from the oceans through convection, and (4) the rate of total heat gain by the atmosphere through convection. The historical development of each of these aspects of energy transformation is followed by an extensive review of the author's own contributions which are of major importance. The review contains maps showing the annual values of the rate of exchange of sensible heat between ocean and atmosphere, and annual range of the rate of

energy loss from the sea surface through evaporation, annual range of rate of total energy loss from the ocean surface through convection, annual values of rate of total energy gain by the atmosphere through exchange of sensible heat with sea surface and through condensation, and the annual value of the surplus of energy available in the latent form of water vapor for the North Atlantic and North Pacific. Seasonal values of the various aspect of energy exchange in different latitude zones are given in tables. Suggestions for further research are presented. *Subject Headings:* **1. Energy exchange between sea and atmosphere 2. Compendium articles.** —*I.L.D.*

4.1–6 551.593

Neuberger, Hans (*Penna. State College*), **General meteorological optics.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 61–78. 14 figs., 9 tables, 59 refs.) **MH-BH**—Some original observations made by MILLER (1943 and 1945) at Pennsylvania State College on the apparent shape of the sky are summarized. The sky appears flattest on a cloudy day and most arched on a moonless night, flatter when cloudy than clear, but effect of cloud type is greater than that of cloud amount, and is not consistent with increasing cloud height. Horizon distance has greater effect than visibility. Related problems of apparent size of sun and moon are considered. Overestimation of angular elevations is 100% for small elevation angles, and near zero at zenith. Overestimation of height of mountains or of cloud amount is related. Psychological and other physical factors prevent any quantitative correction factor being applied. Refraction phenomena are next considered. Terrestrial refraction and astronomical refraction are distinguished. *Subject Headings:* **1. Atmospheric optics 2. Shape of sky 3. Compendium articles.**—*M.R.*

4.1–7 551.509.67:551.574.1

Schaefer, Vincent J. (*General Electric, Schenectady, N. Y.*), **Snow and its relationship to experimental meteorology.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 221–234. 17 figs., table, 43 refs.) **MH-BH**—The many and varied and often beautiful forms in which snow or ice may occur in nature are discussed and nicely illustrated, and the methods of preserving and photographing such forms or crystals mentioned. Seeding in nature (from Ci clouds or spontaneous freezing in supercooled clouds) and the time required for ice forms to fall, liquid water content of stratus or cumulus clouds, freezing nuclei and condensation nuclei necessary for precipitation. Electrical properties of snow and charges in snow clouds, factors affecting supercooled clouds and finally, the use of dry ice, silver iodide and other seeding methods to control weather: induce or prevent precipitation, snow, hail, thunderstorms, to dissipate clouds are adequately discussed and illustrated. Limitations to success in seeding are outlined but the outlook described as hopeful for both scientific and practical purposes under certain specified and limited conditions. *Subject Headings:* **1. Cloud seeding 2. Artificial precipitation 3. Cloud physics 4. Weather control 5. Compendium articles.**—*M.R.*

4.1–8 533.16(02)

Schlichting, Hermann, **Grenzschicht-Theorie.** [Boundary layer theory.] Karlsruhe, G. Braun, **1951.** 483 p. 295 figs., tables, refs. at end of each chap., bibliog. p. 475–7. Review by H. Lettau in *American Meteorological Society, Bulletin,* 33(4):180–181, **1952. DLC**—The most thorough treatment of turbulence and boundary layer problems yet attempted. This new text contains 24 chapters divided into four main sections. The first section treats of basic laws of turbulent flow (friction, viscosity, eddies, boundary layer theory, turbulent flow in pipes and along a boundary), laws of compressible flow, Navier-Stokes equations, application to spheres. The second section takes up laminar boundary layers in all their ramifications (temperature and pressure effects on flat surfaces in pipes and on spherical surfaces). Pt. C considers the transition from laminar to turbulent flow (origin of turbulence, Lord Rayleigh's laws, gradients, stability, three-dimensional turbulence, etc.). Pt. D is a full treatment of turbulent boundary layers; mean motion, mixing length and other measures of turbulent variations from the mean; wind tunnel turbulence; theoretical solutions by PRANDTL, TAYLOR, VON KÁRMÁN, REYNOLDS; turbulence in pipes, on flat plates and rotating shells; turbulent frictional layer with falling and rising pressure, free turbulence (Reichardt's theory of inductive

turbulence and heat transfer by free turbulence) and finally profile drag and its calculation. There are hundreds of drawings and diagrams, numerous references with each chapter, and a good author and subject index. *Subject Headings:* **1. Turbulence theory 2. Boundary layer theory 3. Textbooks. I. Lettau, Heinz.**—*M.R.*

4.1–9 551.593.7

Sekera, Zdeněk, **Polarization of skylight.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 79–90. 4 figs., 3 tables, 70 refs., 9 eqs.) **MH-BH**—After a preliminary historical note, the author goes into the problem of measurement of (a) the degree of polarization and (b) measurement of the position of the neutral points. The various types of photopolarimeters used to measure degree of polarization described. The merits of photographic over visual observations are discussed. A quadrant theodolite may be used to measure the position of the neutral points and any polariscope for finding the position of the neutral point. Distribution and intensity of polarization in various points of the sky are shown graphically (from results of 4 authors) for various solar elevations, location of neutral points, effect of turbidity and albedo of ground, spectral variations in polarization and anomalies during twilight are discussed in detail from the theoretical as well as observational standpoint. There is a need for instruments with quicker response and greater sensitivity in order to record rapid fluctuations and weaker conditions of polarization. Extension of theory of Chandrasekhar from two to three-dimensional model is also proposed for future consideration, application to problems of turbidity, cloud formation, searchlight measurements of atmospheric structure, water vapor content and albedo studies, as well as daylight, twilight and night illumination investigations are suggested. *Subject Headings:* **1. Sky light polarization 2. Polarimeters 3. Arago's point 4. Compendium articles.**—*M.R.*

4.1–10 551.551:551.554:551.555.1

Sheppard, Percival Albert and Omar, M. H., **The wind stress over the ocean from observations in the Trades.** *Royal Meteorological Society, Quarterly Journal*, 78(338):583–589, Oct. **1952.** 2 figs., 3 tables, 3 refs., eq. **DWB**—In the trades the opposition between the thermal and surface geostrophic wind leads to a maximum wind speed usually below 1 km. The surface drag can be evaluated from components of geostrophic and actual winds at various heights normal to the surface wind. This is done for Wake, Johnson and Eniwetok Island in the Pacific and San Juan in Atlantic, and geostrophic winds from N. Hemisphere charts. Drag coefficients found are about $1.0(\times 10^{-3})$ at Wake and Eniwetok and 1.5 at Johnson (possibly because of roughness due to reefs), irrespective of wind speed. At San Juan it decreased from 9.3 with surface wind 2–7 knots to 2.1 with 16–26 knots, due to temperature variation over larger land area. *Subject Headings:* **1. Wind structure 2. Trade winds 3. Pacific Islands.**—*C.E.P.B.*

4.1–11 551.554

Sheppard, Percival Albert, Charnock, H. and Francis, J. R. D., **Observations of the westerlies over the sea.** *Royal Meteorological Society, Quarterly Journal*, 78(338):563–582, Oct. **1952.** 7 figs., 3 tables, 14 refs., 4 eqs. **DWB**—Observations at 50 m intervals up to 800 m were made from boat near Scilly Island, using balloons rising $1–1\frac{1}{2}$ m/s, in W winds in Jan. 1951. It was found that vertical gradient of wind speed was similar at all levels, wind at 300 m averaging 21% stronger and veering 3.6° from surface wind. Vector change 200–500 m is due to thermal wind. Turbulence increases with height. Surface wind departs little from isobars and is more often towards high pressure than low. A generalized principle of momentum transfer over the sea is deduced in which the classical conception of the frictional boundary layer has little validity. Detailed observations are appended. *Subject Headings:* **1. Wind profile measurements 2. Wind shear 3. Scilly Islands.**—*C.E.P.B.*

4.1–12 551.578.7:629.135:016

†Souter, Robert K. and Emerson, Joseph B. (*Langley Aero. Lab., Langley Field, Va.*), **Summary of available hail literature and the effect of hail on aircraft in flight.** *U. S. NACA, Technical Note*, 2734, Sept. **1952.** 162 p. 30 figs., 6 tables, bibliog. p. 93–162. **DWB**—Available information on the hail phenomenon affecting aircraft in flight has been examined.

This paper attempts to coordinate the present knowledge of hail with the effect of hail on aircraft in flight and includes (1) a digest of the literature on the physical properties, the occurrence, and the formation of hail; (2) a survey of the hail effect on aircraft in flight from analyses of 57 cases of airplanes damaged by hail; (3) a résumé of hail information for the benefit of pilots, forecasters and ground operational personnel; and (4) a hail bibliography of 552 articles for use of research personnel. The bibliography is arranged according to seven general classes and chronologically within each class. Many items are annotated. *Subject Headings:* **1. Hail bibliographies 2. Hail formation 3. Hail damage 4. Aircraft damage. I. U. S. NACA.**—*From authors' abstract.*

4.1–13 551.509.22

*U. S. Weather Bureau, **Normal weather charts for the Northern Hemisphere.** *U. S. Weather Bureau, Technical Paper*, No. 21, Oct. 1952. 74+p. 48 charts, 20 pages of tables, refs. p. 6. Price: $1.75. **DWB**—New normals are presented for each month of the year in the Northern Hemisphere (north of 15°N lat.) for the following meteorological elements: sea level pressure, 700–1000 mb thickness, 700 mb height, 700 mb temperature and 500 mb height. These normals are portrayed on maps and are listed in tables which give values for a selected grid of the intersections of latitude and longitude. The introduction contains a brief history of the evolution of normals and a discussion of the concept of normals and normal charts. The method of preparation is explained and the reliability of the normals is evaluated. *Subject Headings:* **1. Normal weather charts 2. Northern Hemisphere. I. Namias, Jerome E. II. Clem, LeRoy H. III. U. S. Weather Bureau. Extended Forecast Section IV. Pineapple Research Institute of Hawaii V. Hawaiian Sugar Planters' Association.**—*M.R.*

4.1–14 551.594.13

†Wait, G. R. and Parkinson, W. D., **Ions in the atmosphere.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 120–127. fig., 4 tables, 58 refs., 9 eqs.) **MH-BH**—In discussing the broad subject of ions in the atmosphere, the authors' have outlined briefly the historical researches on this subject and then proceeded to discuss current concepts on ionic mobility, nature of slow ions, rate of ionization, small ions (balance, recombination and combination with condensation nuclei), large ions balance, ionic concentration in the lower atmosphere, variations in time and with height, ratio of positive to negative ion concentration, average life of an ion, and finally a few of the unsolved problems in research on ions. *Subject Headings:* **1. Ions in the atmosphere 2. Ion mobility 3. Compendium articles.**—*M.R.*

4.1–15 551.510.5:551.590.25

Whipple, Fred L., **Meteors as probes of the upper atmosphere.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 356–365. 3 figs., table, 95 refs., 7 eqs.) **MH-BH**—A thorough exposition of every possible aspect of meteor study which could apply to meteorology. The article begins with a history of such study, origin of meteoric bodies, definition of terms and limits of velocity of meteor fall, chemical composition as determined by spectra indicated temperatures, fragmentation in atmosphere or flaring due to crumbling. Visual methods of observing height by triangulation were begun in 1798. Later, LINDEMANN and DOBSON used data to determine temperature, density, high level wind drift and turbulence. Height varies from night to day and lower daytime levels are attended by lower average wind speeds. Photographic studies made since 1893 at Yale and more recently at Harvard are used to develop theories which enable computation of air density

$$\rho_0 = -\frac{2^{\frac{1}{2}} V_0'}{\gamma A \tau_0^{\frac{1}{2}} V^2} \left[\int_{t_0}^{\infty} (I/V^2) dt\right]^{\frac{1}{2}}$$

when mass, rate of mass loss, luminosity, acceleration and drag coefficient are first calculated. Errors arise from assumption that drag coefficient γ is constant with respect to velocity and density. These errors will be greatest at great altitudes where γ is large. Comparison with NACA standard atmosphere shows marked similarity (although both curves are anchored to same base at 50–60 km, and NACA atmosphere derives in part from same data). Residuals

show strong seasonal correlation and correlation with surface temperatures but not with fronts, declination of sun or sunspot number. Advances will come from modern radio meteor observation techniques, although there are limitations even to this method. Increased observational accuracy, laboratory studies on the drag and heat transfer coefficients, and study of the physical and chemical nature of meteorites will also contribute to progress. Difference between two methods of radio observation; the pulse packet and the continuous transmission (Döppler) method is explained. *Subject Headings:* **1. Atmospheric structure 2. Meteor observation 3. Radio observation 4. Compendium articles.**—*M.R.*

GENERAL METEOROLOGY

4.1–16 551.5

Thomson, Andrew, **A tribute to the weather man.** *Weather*, 7(6):189–190, June **1952. DWB**—Reprint from *Hamilton Spectator* Feb. 8, 1952 about research at lonely Arctic stations. *Subject Heading:* **1. Meteorological research.**—*C.E.P.B.*

4.1–17 551.5 551.58 551.586(02)

Voigts, Heinrich, **Wetter, Klima, Leben.** [Weather, climate, life.] Hildesheim, A. Lax, **1949.** 140 p. **DLC**—A concise and elementary textbook providing: 1) an account of physical weather processes and of the formation of large scale weather, 2) an explanation of the weather map, 3) the physical basis of the thermal balance of the human body and the measurement of heat loss and 4) the relationship between microclimate and plant climate and between weather and crop yield. The chapters are as follows: (1) Importance of clouds in the recognition of atmospheric processes; upslide and invasion of fronts; (2) Wind (includes measurement of wind velocity and direction, wind protection etc.); (3) Weather and weather map, (4) Large scale weather and weather processes; (5) Climate, weather and man; measurement of cooling off by katathermometer and frigorimeter; measurement of total radiation; (6) Microclimate and plant-climate (a summary of GEIGER's "Climate near the ground") and (7) Weather and yield of grain crops, fruits and vegetables. There are numerous illustrations and diagrams. *Subject Headings:* **1. Meteorology 2. Climatology 3. Bioclimatology 4. Textbooks.**—*I.L.D.*

4.1–18 551.50:6

Ashley, Frances, **New frontiers in meteorology.** *Occupational Trends*, Boston, May-June **1951.** 5 p. photos. Abstracted from reprint. **MH-BH**—Brief survey of employment opportunities in various branches and grades of the meteorological field, indicating duties, salaries and demand for professional and nonprofessional personnel, male and female. Photographs show meteorologists in action. *Subject Headings:* **1. Meteorological careers 2. Applied meteorology.**—*G.T.*

4.1–19 551.50:6

U. S. Air Force. Geophysical Research Center, **Research opportunities for chemist physicist $4,600 to $10,000 per year; meteorologist $3,825 to $10,000 per year.** Cambridge, Mass., U. S. Air Force Cambridge Research Laboratories, Sept. 12, **1950.** 21 p. **DWB**—The pamphlet sets out the qualifications for posts in the Geophysical Research Directorate and the fields of work in cloud mechanics, atmospheric physics and chemistry, electromagnetic wave motion, synoptic analysis (including extended and long range forecasting) and atmospheric hydrodynamics. *Subject Headings:* **1. Meteorological careers 2. Meteorological research 3. U. S. Air Force Cambridge Research Center.**—*C.E.P.B.*

4.1–20 551.5(02)

Little, W. B. and Dury, G., **Science and the weather.** 2nd ed. London, Sir Isaac Pitman & Sons., Ltd., **1951.** 110 p. 30 figs., tables. **GB-MO**—An excellent popular account of meteorology, with descriptions of easily made experiments. After dealing with the atmosphere, solar radiation, winds, humidity and precipitation, etc., the last chapter analyzes 8 typical weather charts over the British Isles. *Subject Headings:* **1. Manuals 2. Elementary meteorology.**—*C.E.P.B*

4.1–21 551.5(09)

Dufour, Louis, **Marcel Proust et la météorologie.** [Marcel Proust and meteorology.] *Brussels. Université. Revue de l'Université de Bruxelles*, 3/4, **1950/51.** 9 p. Abstracted from reprint. **DWB**—Examining a selection of more than eighty passages taken from one of the well-known French fiction writer's books, the author finds that meteorology occupies a comparatively small space in Proust's writings. On the other hand, it is pointed out that PROUST's accounts of atmospheric phenomena are of definite scientific interest, even though they are given in a descriptive rather than analytic manner. The relevant passages are quoted in full. *Subject Headings:* **1. Meteorology 2. Proust, Marcel.**—*G.T.*

4.1–22 551.5(09)

Gal'tsov, A. P., **Kak predskazyvaiut pogodu.** [How to forecast the weather.] Moscow, Gosizdat., **1951.** 72 p. 23 figs. **DLC**—A popular booklet for children. Contains also interesting historical remarks about the development of meteorology in Russia. Meteorological observations in St. Petersburg (Leningrad) go back to 1725. The first meteorological network was established by BERING in Siberia (1737–1749; 11 stations). A central meteorological service has existed since 1849, telegraphic service since 1856 and daily weather reports since 1872. The storm forecasting service for the sea was established in 1874. Use of radiosondes begins in 1928 (MOLCHANOV). *Subject Headings:* **1. History of meteorology 2. Juvenile literature 3. U.S.S.R.**—*A.A.*

4.1–23 551.5(09)(52)

Wadati, K., **National report on meteorological research in Japan 1939–1947.** *International Union of Geodesy and Geophysics. Association of Meteorology, Oslo, 1948, Procès-verbaux*, 3:172–184, Nov. **1950. DWB**—Statistics on the number of stations in Japan in 1941 and 1948 are accompanied by an account of organizational and personnel changes during and after the war. Progress in various fields of meteorology during the period 1939–1948 is outlined in detail and a long list of publications appended. Finally, there is a list of important phenomena such as typhoons, droughts, heavy snowfall, etc. for 1939–1947. *Subject Headings:* **1. Meteorological services 2. Meteorological research 3. Progress in meteorology 4. Japan.**—*M.R.*

4.1–24 551.5:06:(09)(495)

Greece. Ministry of Coordination, **The national meteorological service.** *Greece. Ministry of Coordination, Battle for Survival*, No. 6:83–85, Aug. 9, **1950.** illus. **DWB**—The history of meteorology in Greece is briefly summed up. Meteorological stations operating in 1940 and at present and those planned for the future are listed and their locations shown on maps. It is pointed out that owing to difficulties in appropriations it has not yet been possible to raise the standard of the meteorological network to the pre-war level. Ten stations run by a full-time staff, 6 with Air Force personnel and 46 with part-time employees are operating at present, but only part of these are able to produce satisfactory results. Only the Ellenikon station at Athens supplies upper air data. The re-organization of the meteorological network under the Marshall Plan is discussed. Photos showing installations and equipment of observatories are presented. *Subject Headings:* **1. Meteorological networks 2. Greece.**—*G.T.*

4.1–25 551.5:06:(05)(64)

Rapport sur les travaux météorologiques du Service de Physique du Globe et de Météorologie de l'Institut Scientifique Chérifien de 1939 à 1948. [Report on meteorological work of the Service de Physique du Globe et de Météorologie de l'Institute Scientifique Chérifien from 1939 to 1948.] *International Union of Geodesy and Geophysics, Association of Meteorology, Oslo, 1948, Procès-verbaux*, 3:185–186, Nov. **1950.** In French. **DWB**—Work done in the fields of actinometry, climatology, dynamic meteorology, maritime meteorology and publications of the service in Morocco listed. *Subject Headings:* **1. Meteorological services 2. Meteorological research 3. Periodicals 4. Rabat, Morocco. Institut Scientifique Chérifien. Service de Physique du Globe et de Météorologie 5. Morocco.**—*M.R.*

4.1–26 551.5:06(492)

Report on activities in meteorology of the "Koninklijk Nederlands Meteorologisch Instituut," De Bilt, Netherlands. *International Union of Geodesy and Geophysics, Association of Meteorology, Oslo, 1948, Procès-verbaux*, 3:187–193, Nov. **1950.** 18 refs. **DWB**—Problems of physical and dynamical meteorology, synoptic meteorology, climatology and marine climatology outlined at some length. Courses in meteorology and developmental work in instrument design and organization also mentioned. A list of important works published during the war years is appended. *Subject Headings:* **1. Meteorological services 2. Meteorological research 3. Progress in meteorology 4. Netherlands. (K.) Meteorologisch Instituut 5. Netherlands.**—*M.R.*

4.1–27 551.5:06 681.4

U. S. Weather Bureau, **Report of the chief of Weather Bureau, 1946–1951.** *U. S. Dept. of Commerce, Annual Report*, v. 34–39, **1946–1951.** Abstracted from reprint. **DWB**—Five annual reports on the activity of the U. S. Weather Bureau are given. The daily weather service includes the general public service, aviation weather service, hurricane warning service, fire-weather warning service, horticultural protection and the marine weather service. The hydrologic service includes water supply forecasts, river and flood forecasting and warning service. Electronic flood routing machines for flood forecasting are provided. A most important advance in the climatological service is the mechanization of the processing of weather records. A series of new arctic weather stations has been established. The international activity of the Weather Bureau is summarized. Research on thunderstorms, forecasting and solar radiation has been intensified. *Subject Headings:* **1. Meteorological services 2. Annual reports 3. Electronic computers 4. U. S. Weather Bureau I. Reichelderfer, F. W.**—*A.A.*

4.1–28 551.5:016

†Laursen, Vigo (*comp.*) (*Danish Met. Inst.*), **Bibliography for the Second International Polar Year, 1932–33.** Copenhagen, I.M.O. Temporary Committee on the Liquidation of the Polar Year, 1932–33, **1951.** 253 p. **DWB**—This bibliography contains not only references to special contributions to the Polar Year 1932–1933, but also a review of regular and occasional observations made this year over all the world in meteorology, geomagnetism, atmospheric electricity, of auroras, cosmic rays and in hydrography, published or unpublished. The references are arranged according to countries and according to main subjects. No author index is included. *Subject Headings:* **1. International Polar Year 1932–1933 2. Bibliographies. I. IMO. Temporary Committee on the Liquidation of the Polar Year, 1932–1933.**—*A.A.*

4.1–29 551.5:37

Macelwane, James Bernard (*Saint Louis Univ., Inst. of Tech., St. Louis, Mo.*), **A survey of meteorological education in the United States and Canada.** *American Meteorological Society, Bulletin*, 33(2):53–55, Feb. **1952. MH-BH.** Also mimeographed copy. **DWB**—A list of 105 institutions of higher education in the United States and Canada, with the types of courses offered in 1950–51, the number of students majoring in meteorology, degrees in meteorology given between 1949 and 1950 and departments offering courses in meteorology. *Subject Headings:* **1. Teaching of meteorology 2. Meteorological institutions 3. United States 4. Canada.**—*I.L.D.*

4.1–30 551.5:629.13

Benum, F. W. (*Canada. Met. Div., Forecast Services*), **Meteorology and aviation in Canada.** *Royal Meteorological Society, Canadian Branch [Publications]*, 3(1), **1952.** 19 p. 3 refs. **DWB**—In this presidential address delivered to the Roy. Met. Soc., Can. Branch at the annual meeting held in Toronto on Jan. 31, 1952, the history, methods, difficulties and policy of the Canadian meteorological services are discussed. The stimulating effect of the demands of aviation on the development of meteorology is stressed. It is pointed out that one of the main difficulties is the failure of practical meteorologists to incorporate into their methods the new results achieved by scientists. Owing to its particular distribution of population, Canada has a "single service" system which should be improved by the establishment of a

central analysis office, the introduction of national facsimile transmission of weather maps and shift supervisors for each major forecast office. The progress already made toward these goals is indicated. *Subject Headings:* **1. Aeronautical meteorology 2. Canada.**—*G.T.*

4.1–31 551.5:656.7

Campbell-Orde, A. C. (*Br. Overseas Airways Corp.*), **Some practical experience of civil jet transport operation and associated meteorological problems.** *Institute of the Aeronautical Sciences, New York, Preprint*, No. 355, Jan. 28–Feb. 1, 1952. 17 p. in 12. 10 figs. Price: $0.75. **DWB.** Also: *Aeronautical Engineering Review*, New York, 11(3):47–54, March 1952. **DWB**—Based on BOAC experience in civil jet transport from London to South Africa and to Singapore during the period from March–Dec. 1951, the basic meteorological requirements for optimum fuel load are outlined. For take-off a difference of 1°C is equal to 250-400 lb in payload. In range, both wind and temperature must be considered. Diversion to alternates is more critical than for normal transport operation, so terminal weather reports must be made more frequently and transmitted more promptly. Amount of night flying and time spent under icing conditions is reduced. Forecasts and flight plans must cover longer distances and be more accurate for higher elevations (30 to 40 thousand ft). *Subject Headings:* **1. Aeronautical meteorology 2. Jet transport operation 3. Airways forecasting 4. London–South Africa air route. I. British Overseas Airways Corp. (BOAC).**—*M.R.*

4.1–32 551.5:656.7

Meteorology and jet aircraft, I and II. *Aeroplane*, London, 82(2119, 2120):234, 285–286, Feb. 29, March 7, 1952. **DWB**—Statements made by military and meteorological experts during a four-hour symposium on "Meteorology and the operation of jet aircraft," held on Feb. 20, 1952 under the chairmanship of SIR CHARLES NORMAND, president of the Royal Meteorological Society, are summed up. Main subject of the meeting was meteorological elements, especially those connected with high altitudes, which have a stronger effect on jet aircraft than on conventional airplanes. Clouds, fog, turbulence, jet stream, hail, icing, precipitation, static, rain, humidity, forecasting methods and many other problems were discussed. Two of the speakers related having observed clouds at altitudes up to 50,000 ft or more over the tropics and at least 43,000 ft over England. Photographic evidence of clouds at 43,000 ft was produced. *Subject Headings:* **1. Aeronautical meteorology 2. Jet transport operation 3. High altitude flying 4. Airways forecasting.**—*G.T.*

METEOROLOGICAL OBSERVATIONS AND INSTRUMENTS

METHODS OF OBSERVATION

See also: Aid for computing density of upper atmos. (Ashburn), 4.1–76; Reduction of monthly mean values of barom. pressure to mean sea level (Makjanic), 4.1–144; Converting Beaufort to knots (Roll), 4.1–147; Reduction of wind speed measurements on ships to 10 m (Roll), 4.1–148; Measurement of velocity of high alt. winds, Sydney, NSW (Edwards), 4.1–155

4.1–33 551.501.1(02)

Great Britain. Meteorological Office, **Observer's handbook.** London, H. M. Stationery Office, 1952. 216 p. 30 figs., 42 plates, tables. M.O. 554. Price: 12/6. **GB-MO**—This new edition of the "Observer's handbook" follows the same lines as its predecessors. It includes observational routine, clouds, visibility, present and past weather, wind, state of ground, pressure, temperature and humidity, rainfall, sunshine and phenomena. Appendices cover all the details relevant to setting up a meteorological station and compiling monthly returns, airfield fitness, etc., and a number of tables for reduction and conversion of observations. *Subject Heading:* **1. Observers manuals.**—*C.E.P.B.*

4.1–34 551.501.7:551.510.41:546.214

Teichert, F., **Erfahrungen mit chemischen Ozonmessmethoden.** [Experience with chemical methods of measuring ozone.] *Zeitschrift für Meteorologie*, 6(5):132–138, May 1952. 3 figs., 24 refs. **DWB**—A detailed description and critical analysis of the determination

of atmospheric ozone by the chemical methods of REGENER and CAUER and of the silica gel method. The former two methods which employ KI are not precise in contaminated air; the latter is very exact under all conditions but is complicated. The problem of the presence of reducing gases is considered. *Subject Headings:* **1. Ozone measurement techniques 2. Ozonometers.**—*I.L.D.*

4.1–35 551.501.9:551.43

Korff, Serge A. (*New York Univ.*), **The world's high altitude laboratories.** *Physics Today*, New York, 5(5):28–30, May **1952. DWB**—A list of 19 high altitude laboratories in America, Europe and Asia (excluding countries behind the Iron Curtain) is presented in a table indicating name and place, altitude, geomagnetic latitude, geographic location, working season, power supply, available accomodation, access, and name and address of officer in charge. Explanatory notes are added. The location of the laboratories is shown on a map. The highest in the world is Chacaltaya, Bolivia (18,000 ft, 5500 m), and in the U.S.A. Mt. Evans, Colo. (14,150 ft, 4300 m). The author, who has visited most of the laboratories, offers to provide additional information, and correspondence requesting such should be addressed to him at N. Y. Univ.. Univ. Heights, New York 53, N. Y. (*See also* 2.4–11, April 1951, *MAB.*) *Subject Headings:* **1. High altitude observatories 2. Mountain observatories 3. Geophysical observatories.**—*G.T.*

4.1–36 551.501.9:551.585.7(09)(436)

*Lukesch, J. (*Vienna*), **Die Geschichte des meteorologischen Observatoriums auf dem Hochobir, 2041 m.** [History of the meteorological observatory on the Hochobir, 2041 m.] *Sonnblick-Verein, Vienna, Jahresbericht*, 48:25–30, **1950.** 2 figs., table.—Monthly mean and extreme temperature data for the stations Obir I. (1848–1868) and Obir II. (1847–1867) and data on temperature, pressure, wind, cloudiness, precipitation and thunderstorms for Obir III.-Hannwarte (1887–1936) are presented. The history of the stations is outlined. Wartime and post-war events led to the utter destruction of the Hochobir Observatory but it is hoped that it will be rebuilt so that meteorological observation can be resumed. *Subject Headings:* **1. Hochobir Observatory 2. Mountain observatories 3. History of observatories 4. Austria.**—*G.T.*

4.1–37 551.501.9:551.43

Pozzo, Franco (*Chief of Pian Rosa, Italy, Meteor. Station*), **A proposito della stazione di "Pian Rosa."** [A project for a station on Pian Rosa.] *Rivista di Meteorologia Aeronautica*, 10(4):36, Oct.–Dec. **1950.** fig. **MH-BH**—A brief letter, accompanied by a photograph showing plainly the location of the meteorological station under construction, the cosmic ray laboratory and the other buildings, and the adjacent peak nearby. The elevation of the station will be 3490–95 m; thus it will be the second highest in Europe and the highest in Italy. (The Jungfrau station is at 3570 m.) The settlement on the Rosa Plateau is the highest inhabited locality in Italy. *Subject Headings:* **1. High altitude observatories 2. Mountain observatories 3. Pian Rosa, Italy.**—*M.R.*

4.1–38 551.501.9

Rossi, Veikko, **The Sodankylä Meteorological Observatory.** *Geophysica: Meteorology*, Helsinki, 4(1):33–35, **1951.** photo, ref. **DWB**—Coordinates are $\varphi = 67°22'N$, $\lambda = 26°39'E$. Meteorological observations have been carried on without interruption since 1852; radiosonde observations were begun in 1949 *Subject Headings:* **1. Meteorological observatories 2. Sodankylä Meteorological Observatory 3. Finland.**—*A.A.*

4.1–39 551.501.9:551.43(09)

Rossmann, Fritz, **Zur Geschichte der Bergwetterwarten.** [On the history of mountain meteorological observatories.] *Meteorologische Rundschau*, 5(3–4):63–65, March–April **1952. DWB**—Describes numerous scientific mountain ascents especially in Germany 1775–1790, founding of Hohenpeissenberg Observatory (1000 m) 1781, and great development of mountain observations after 1865. *Subject Headings:* **1. Mountain observatories 2. History of meteorology.**—*C.E.P.B.*

4.1–40 551.501.9:551.585.7

von Ficker, Heinrich (*Vienna*), **Die Wichtigkeit der Bergobservatorien für die Meteorologie der Gegenwart.** [The importance of mountain observatories in present-day meteorology.] *Sonnblick-Verein, Vienna, Jahresbericht*, 48:4–6, **1950.**—In a plea for more meteorological observations on mountain peaks, the author takes a stand against the belief, popular in the early days of aerological observation, that soundings obviate the necessity of surface measurements at high altitudes. He argues that high altitude ground observations complement rather than duplicate aerological data. Author claims that for continuous records, or simultaneous measurement of temperature and pressure on peaks and in valleys, for precipitation measurement, for radiation measurement and for visual observation, mountain observatories are still unmatched and their importance is still increasing as aeronautical activities expand. *Subject Headings:* **1. Mountain observations 2. High altitude observatories.**—*G. T.*

4.1–41 551.501.9(09)(494)

†von Muralt, Alexander L. (*Bern Univ., Switzerland*), **Fünfzehn Jahre Hochalpine Forschungsstation Jungfraujoch.** [Fifteen years of the Jungfraujoch Alpine Research Station.] Bern, Hochalpine Forschungsstation Jungfraujoch, **1946.** 45 p. 17 figs., bibliog. p. 33–45. **DLC**—The history of human activities on the Jungfrau, marked by the first ascent in Aug. 1811, the construction of a railway from 1896 to 1912, the opening of the Scientific Station in 1931, etc., is summed up. Scientific work includes optical research, measurement of cosmic rays and of ozone, meteorological observation, investigation of snow and glaciers and observation of biological effects of altitude. A statistical survey of the use of the station is given and facilities available are described. The pamphlet includes information regarding organizational and administrative set-up of the international foundation in charge of the station (including names of members and staff and text of the document under which the station was founded). A list of 238 publications prepared by the establishment is attached. Photos showing exterior and interior views of the station are presented. *Subject Headings:* **1. Mountain observatories 2. History of observatories 3. Jungfrau, Switzerland. I. Jungfraujoch Scientific Station.**—*G. T.*

OBSERVATIONAL DATA

See also: Statistics on surface winds, Madagascar . . . (Ravet), 4.1–149; European monsoon, Netherlands (Visser), 4.1–150; Rainfall in Madagascar (Ravet), 4.1–179; Summary of weather conditions, East Lansing, to 1950 (Baten), 4.1–216.

4.1–42 551.506:551.55(45)

*Aliverti, Guiseppina and Avico, E. (*Naples, Istituto Superiore Navale*), **Sul vento prevalente a Pavia.** [Prevailing winds in Pavia.] *Annali di Geofisica*, 5(1):33–39, Jan. **1952.** Eng., 4 tables. English summary p. 39. **MH-BH**—Data on directional distribution of winds in Pavia are presented in terms of length of trajectory, duration, velocity and frequency, for the whole year and for each season; they represent averages obtained from 7-year records (1943–1949) based on continuous observation over 24 hours. The results are compared with corresponding data obtained over the same period by observation 3 times daily (at 8 a.m., 2 p.m. and 7 p.m.). Considerable discrepancy between these two sets of data is partly attributed to the difference in the daily duration of observation but it is pointed out that even if the 3-hour observations were made over a period 8 times as long as that of the 24-hour observation, discrepancies would still remain because the hours chosen are not necessarily as significant for wind velocity as they may be for some other meteorological elements. *Subject Headings:* **1. Wind data 2. Pavia, Italy.**—*G. T.*

4.1–43 551.506.1(994)

Falkland Islands and Dependencies. Meteorological Service, **Annual report for the year 1950.** [1952?] 6 p. **DWB**—Report describes forecast service for whaling ships (broadcast in English and Norwegian from Port Stanley and South Georgia) and upper air work at Port Stanley. Also lists 7 observing stations where 3-hourly and pilot balloon observations are made and 4 subsidiary stations. Communications are described and plan for regular meteoro-

logical and climatological summaries (daily, monthly and annual) to begin in 1951 are outlined. Observations have been made in the Falkland Islands since 1850. Forecast office was opened at Port Stanley by Royal Navy in 1941 and work was taken over by Meteorological Office, London in 1947. Service is now unified under Falkland Islands administration. *Subject Headings:* **1. Meteorological services 2. Forecast dissemination 3. Annual reports 4. Falkland Islands 5. South Georgia, Antarctica.**—*M.R.*

4.1–44 551.506.1(45)

*Polli, Silvio, **Osservazione meteoriche eseguite a Trieste nel 1947 . . . 1949.** [Meteorological observations made at Trieste in 1947 . . . 1949.] *Istituto Talassografico, Trieste, Pubbl.*, No. 261, 269, **1951.** [20] p. tables, refs. **DWB**—Detailed daily, monthly and annual values of all of the usual meteorological elements (in some cases for 3 times a day), plus notes on the weather during the year and a brief history of records at Trieste. *Subject Headings:* **1. Observational data 2. Yearbooks 3. Trieste.**—*M.R.*

4.1–45 551.506.13(497.1)

***Vreme u Beogradu jun 1949–februar 1951.** [Weather at Belgrade June 1949–February 1951.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorološki Glasnik*, 3:100–103, **1951.** In Croatian. **DWB**—Brief monthly weather summaries and a tabular survey of monthly values of mean, minimum and maximum temperature, the number of days with a min. below 10°C, a max. below 0°C, a min. above 20°C, a max. above 25°C; the number of days with hoar frost, dew, fog and thunderstorms; relative humidity, cloudiness, precipitation, insolation and atmospheric pressure are presented. Long period mean values are also indicated. *Subject Headings:* **1. Monthly summaries 2. Temperature variations 3. Belgrade, Yugoslavia.**—*G.T.*

4.1–46 551.506.5(988)

Bauer, Albert, **Wissenschaftliche Ergebnisse der französischen Polarexpedition (II. Grönland 1948).** [Scientific results of the French Polar Expedition (II. Greenland 1948).] *Naturwissenschaftliche Rundschau*, 5(2):49–54, Feb. **1952.** 18 figs., refs. **DWB**—Describes seismic measurements of ice thickness and gives a profile showing a maximum depth of 3400 m, borings in firn showing density and temperature to a depth of over 125 m at center (−28°C) and near edge (−16°C). Work with radiosondes and pilot balloons, and investigations of temperature gradient, 0–10 m above ice, cosmic radiation, microphotography of snow crystals, etc. are listed but not described. *Subject Headings:* **1. Arctic expeditions 2. Greenland.**—*C.E.P.B.*

INSTRUMENTS

See also: Improved dew point hygrometer for high alt. (Storey), 4.1–56; Pressure, density, temperature of earth's atmosphere to 160 km (Havens), 4.1–75; Earth's atmosphere, Arctic (Alaska. Univ. Geophysical Inst.), 4.1–78, 4.1–79; Heat balance measurements (Deij), 4.1–117; Direct determination of components of heat balance of earth's surface (Aĭzenshtat), 4.1–118; Solar radiation, Belgrade (Savič & Milosavljevič), 4.1–120; Solar radiation, Gdansk, Sopot, Gdynia compared with Warsaw (Gorczyński), 2.1–125; Ionospheric wind measurements at 150 Kc/s (Millman), 4.1–156; Vertical wind velocity in atmosphere, methods of measurement (Konstantinov), 4.1–157; Evaporation measurements, Poland (Schmuck), 4.1–163; Experiments with water drops, interaction between them at terminal velocity in air (Blanchard), 4.1–189; Bibliography on the theory of turbulence, 4A–1 to 4A–205

4.1–47 551.508.53:551.55

Deacon, E. L. (*Met. Sec., Chem. Defence Estab., Porton, Wilts.*), **The over-estimation error of cup anemometers in fluctuating winds.** *Journal of Scientific Instruments*, London, 28(8): 231–234, Aug. **1951.** 4 figs., 4 refs. **DLC**—Experiments were made to obtain the over-estimation errors of Sheppard and Meteorological Office pattern cup anemometers. The results are compared with SCHRENK's theory and observation results (*Zeitschrift für technische Physik*, 10:57, 1937). A fairly good agreement is found. Changing the cup form from the hemispherical to the conical pattern results in only a slight decrease in the over-estimation

ror. *Subject Headings:* **1. Instrumental errors 2. Anemometers 3. Wind measurements. Schrenk, O.**—*A.A.*

4.1–48 551.508.53

Schindler, Gerhard (*Bad Homburg*), **Verbesserung der Wild'schen Windfahne durch nbringung einer elektrischen Meldevorrichtung.** [Improvement of the Wild wind vane by taching an electrical signalling device.] *Wetter und Leben*, Vienna, 3(11/12):267, Dec. 51. **MH-BH**—In order to enable precise determination of intermediate wind directions, e author modified the Wild wind vane—eight conduction wires were eliminated so that only ght contact buttons sufficed. The construction of the proposed improvement and the ethod of registering automatically wind direction are described in detail. *Subject Headings:* **Wind vanes 2. Wild wind vane.**—*I.L.D.*

4.1–49 551.508.53/4

Lovelock, J. E. and Wasilewska, F. M. (*Salisbury, Eng.*), **An ionization anemometer.** *urnal of Scientific Instruments*, London, 26(11):367–370, Nov. **1949.** 7 figs., 2 refs. **DLC**— n omnidirectional, rapid response anemometer and a unidirectional anemometer and flow- eter which give accurate measurements of air movements as slow as 10 ft/min, based on the obility of ions in an electric field and consequent electric current changes, is described and ustrated. Construction, calibration and testing details are given in text and graphically. rrors due to pressure, temperature, humidity and wind direction are minimized. *Subject eadings:* **1. Anemometers 2. Ionization anemometers.**—*M.R.*

4.1–50 551.508.53/4

Whitaker, A. (*Nash and Thompson, Ltd. Surrey, England*), **A vectorially integrating emometer.** *Journal of Scientific Instruments*, London, 26(11):377–378, Nov. **1949.** fig. **LC**—An instrument which will produce a 4-point wind rose directly is described. The emometer cups transmit the speed of rotation through a billiard ball floating in mercury, and e wind vane through a change in the plane of rotation of the ball, and thence through 4 ectrical contacts to solenoid-operated counters. The instrument is sensitive for winds 5 mph and is said to be weatherproof and capable of being artificially heated to prevent ndensation. *Subject Headings:* **1. Anemometers 2. Wind roses 3. Vectorially integrating emometers.**—*M.R.*

4.1–51 551.508.53/4:621.315

Yakame, K., **A distant wind direction and velocity recording instrument.** *Meteorological ciety of Japan, Journal, 2nd Ser.*, 29(8):281–284, Aug. **1951.** 6 figs. In Japanese, English mmary p. 284. **MH-BH**—Wiring diagrams and photographs are shown of a cup anemometer d vane. The instrument is on a hill and records at Hachijo-jima 10 km distant, but it n work up to 50 km on a 12 v storage battery and 100 v a.c. *Subject Headings:* **1. Distant cording equipment 2. Anemographs.**—*C.E.P.B.*

4.1–52 551.508.53/4

Yakame, K., Fujii, Y., Matsumoto, M. and Yokota, S., **On a new pressure-tube anemo- aph combined with electric anemoscope.** *Meteorological Society of Japan, Journal, 2nd r.*, 29(9):298–303, Sept. **1951.** 8 figs. In Japanese, English summary p. 303. **MH-BH**— escribes and illustrates an anemometer in which wind pressure is transmitted by a Pitot be; curved levers make the record proportional to wind velocity instead of pressure. Direc- n is recorded electrically in steps of 5°. *Subject Heading:* **1. Anemographs.**—*C.E.P.B.*

4.1–53 551.508.71

Kawano, Y., **Stream velocity in the ventilation cylinder of the C.M.O.II type aspiration ychrometer.** *Journal of Meteorological Research*, Tokyo, 3(12):431–433, Sept. **1951.** 5 figs., refs., eqs. In Japanese, English summary p. (26)–(27). **MH-BH**—The effective wind locity in the C.M.O. II type aspirating psychrometer was measured by the pressure method which mean wind velocity is measured 1) by the equation $p = 1/2 \times \rho v^2$ (p = pressure difference served, ρ = air density and v = wind velocity), 2) by the cooling rate method, that is from the ation between cooling rate of the thermometer in the C.M.O. wind tunnel and that in the

psychrometer, and 3) from the relation between indications of the wet bulb thermometer in the wind tunnel and in the psychrometer. The three methods give corresponding values. *Subject Headings:* **1. Aspiration psychrometers 2. Instrument comparisons.**—*From author's abstract.*

4.1–54 551.508.71(085)

Negretti and Zambra, [Firm of], **Hygrometers, indicating, recording.** Its: *List H20* London, **1951.** 43 p. illus. **GB-MO**—This catalog opens with a brief account of the principles and types of hygrometers. Types are described and illustrated under headings wet and dry bulb mercury-in-glass, hair, bimetallic recording, wet and dry bulb mercury-in-steel, Gregory electrolytic (wiring diagram shown) and wet and dry bulb electrical resistance. Gives also humidity tables for ventilated dry and wet bulb. The types cover meteorological as well as industrial purposes. *Subject Heading:* **1. Hygrometers.**—*C.E.P.B.*

4.1–55 551.508.7

Robitzsch, Max, **Zur Methodik der Psychrometermessungen.** [On the technique of psychrometer measurements.] *Zeitschrift für Meteorologie,* 6(1):26–27, Jan. **1952. MH-BH**—A critical comment on an adjustment to the aspiration psychrometer proposed by Emil Kirschbaum and Josef Lise ("Neue Erkenntnisse über den Verdunstungsvorgang" in *Chemie-Ingenieur-Technik*, March 1949) for eliminating errors during the investigation of drying at relatively high temperatures. In order to correct the error in the wet bulb thermometer produced by radiation from the radiation shield of the aspirating thermometer, the radiation shield was transformed into a wet body. This procedure increases the inertia of the wet bulb thermometer in comparison to that of the dry bulb. For eliminating error the Fuess aspiration psychrometer, in which both thermometers in their entirety are subjected to the ventilating current, is recommended. *Subject Headings:* **I. Aspiration psychrometers I. Kirschbaum, Emil II. Lise, Josef.**—*I.L.D.*

4.1–56 551.508.71:551.571.7:551.507.35

Storey, D. R., **An improved dew point hygrometer for use at high altitude.** *National Research Council of Canada, Report,* No. MD-28, Aug. **1948.** 6 p. diagrs., table. **DWB**—A description, with diagrams and photographs, of an experimental hygrometer employing the photoelectric principle and containing an electronic circuit capable of maintaining the mirror temperature in equilibrium at the dew point and thus enabling relative humidity to be measured by dew point at temperatures below 32°F. Results of a flight test at 32,000 ft and −32°F are given. *Subject Headings:* **1. Dew point hygrometers 2. Upper air humidity. I. National Research Council of Canada. Div. of Mechanical Engineering.**—*I.L.D.*

4.1–57 551.508.7

Baumbach, S., **Vergleichsmessungen mit verschiedenen Verdunstungsmessern unter definierten Versuchsbedingungen.** [Comparative measurements with different evaporimeters under defined conditions.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte,* No. 35:211–216, **1952.** 2 figs. **MH-BH**—Comparative measurements were made in a wind tunnel, at different wind speeds and radiation at 45°, of Robitzsch-Leistner (white), Piche (white, green, black, white with radiation shield) and Wild evaporimeters. The results differed greatly. A long discussion followed, in which W. Haude described experiments with clay pots in bare soil and different types of vegetation. *Subject Headings:* **1. Evaporation instruments 2. Instrument comparisons.**—*C.E.P.B.*

4.1–58 551.508.7

Boss, G., **Die Brauchbarkeit des Piche-Evaporimeters bei Verdunstungsmessungen** [The use of the Piche evaporimeter in evaporation measurements.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte,* No. 35:194–202, **1952.** 15 figs. **MH-BH**—Author describes measurements of diurnal variation of evaporation with modified Piché evaporimeters exposed in the open at various heights (2–160 cm) in S.W. Africa. These were compared with transpiration from desert plants with their roots in rubber balloons containing water. Agreement was good. He then describes 2 new recording evaporimeters—one photochemical, the other mechanical. *Subject Headings:* **1. Evaporation measurement 2. Piché evaporimeter**—*C.E.P.B.*

4.1–59 551.508.72 551.573

Leistner, Walter, **Ergebnisse vergleichender Verdunstungsbeobachtungen.** [Results of comparative evaporation observations.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:202–210, **1952.** 12 figs., 3 refs. **MH-BH**—Author compares evapotranspiration from potted tomato plants and evaporation by Leistner-Robitzsch spherical evaporimeter and discusses results taking account of sunshine, wind speed and relative humidity. In Pt. 2 he describes a new recording apparatus for the Leistner-Robitzsch evaporimeter and gives records comparing results with Wild-Lambrecht apparatus. *Subject Headings:* **1. Evaporation instruments 2. Evaporation measurement 3. Evapotranspiration.**—*C.E.P.B.*

4.1–60 551.508.761:551.574.1:77

McCullough, Stuart and Perkins, Porter J., **Flight camera for photographing cloud droplets in natural suspension in the atmosphere.** *U. S. NACA, Research Memorandum*, E50K01a, June **1951.** 23 p. diagrs., photos., graphs, refs. **DWB**—Report on cloud droplet photograph experiments made with a shadowgraph optical system and camera developed by the NACA Lewis Laboratory. Magnification of 32 times is said to account for droplets greater than 5 microns, at flight speeds up to 150 mph. Flight tests are claimed to have shown that approximate droplet-size distribution studies can be obtained. Diagrams and photos of instruments and cloud droplet photos taken in flight are presented. *Subject Headings:* **1. Cloud droplet photography 2. Drop size distribution 3. Flight cameras. I. U. S. NACA.**—*G.T.*

4.1–61 551.508.822:551.521

Raunio, Niilo, **Amendments to the computation of the radiation error of the Finnish (Väisälä) radiosonde.** *Geophysica: Meteorology*, Helsinki, 4(1):14–20, **1951.** 2 figs., 13 equations, 3 refs. **DWB**—The Väisälä formula for the radiation error is improved, so that the calculation of the rate of ascent of the radiosonde, of the influence of the sun's height angle and of the pressure at the radiosonde is made more exact. *Subject Headings:* **1. Väisälä radiosonde 2. Radiation calculations.**—*A.A.*

SYNOPTIC ANALYSIS AND FORECASTING

See also: Use of clouds in forecasting (Brooks, C. F.), 4.1–2; Normal weather charts, N. Hemisphere (U. S. Weather Bureau), 4.1–13; Relation of Yugoslavian to European deformation field (Obuljen), 4.1–99; Spring tornadoes and tornado warning service, 4.1–109; Clouds. Weather and causes (Cannegieter), 4.1–170.

4.1–62 551.509.1:551.509.312

Angervo, J. M. (*Fennest Met. Service*), **A proposition for the more accurate definition of the course of the barometric curve in weather reports.** *Geophysica: Meteorology*, Helsinki, (1):21–27, **1951.** 10 figs., 13 refs., 9 eqs. **DWB**—The new symbol a_z which characterizes the barographic curve in the meteorological code of Jan. 1, 1949 is criticized as making too high demands on observers as well as on equipment. The author proposes to give a more exact approximation value for $\frac{\partial p}{\partial t}$ and $\frac{\partial^2 p}{\partial t^2}$ by a different method. *Subject Headings:* **1. Barometric tendencies 2. Meteorological codes.**—*A.A.*

4.1–63 551.509.31

James, R. W., **Synoptic morphology—a neglected study.** *American Meteorological Society, Bulletin*, 33(2):39–41, Feb. **1952.** 4 refs., 2 eqs. **MH-BH**—It is suggested by the author that the accuracy of forecasting can be improved by introducing quantitative methods to the study of atmospheric perturbations. The parameters necessary to characterize the structure of circular vortexes are an intensity factor describing the extent to which surface pressure in a vortex falls below or rises above a normal value; a scale factor describing the area of vortical influence and a vortex profile, a mathematical relationship expressing the variations of pressure or wind in various parts of the vortex. The author derives equations expressing the pressure profiles in occlusions and in anticyclonic profiles, respectively. *Subject Headings:* **1. Vortexes 2. Anticyclone structure 3. Synoptic patterns 4. Synoptic morphology.**—*L.D*

4.1–64 551.509.33:517.512.2

Imahori, K. and Kobayashi, T., **On the long period forecasting by means of harmonic analysis** (1). *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(11):365–378, Nov., **1951.** 3 figs., eqs. **MH-BH**—A carefully elaborated theory which is based upon the methods of KOLMOGOROV and WIENER is presented. The possibility of linear prediction is assumed. The decomposition of time series and the application of harmonic analysis are discussed. The examples given do not provide convincing evidence of the usefulness of the method. *Subject Headings:* **1. Harmonic analysis 2. Long range forecasting. I. Kolmogorov, A. N. II. Wiener, N.**—*A.A.*

4.1–65 551.509.33:551.553.21

Ressinck, J. J. M., **Some remarks on monsoon forecasting for Java.** *Indonesia. Djawatan Meteorologi dan Geofisik, Verhandelingen*, No. 44, **1952.** 22 p. 10 figs., 3 tables, 22 refs. **DWB**—The author summarizes the logical and statistical bases underlying the calculation of correlation coefficients and using examples of correlation between atmospheric pressure at various localities and the onset of the west monsoon in Java he points out the "danger of a formal mathematical system of selection of weather factors to be included" in regression equation for forecasts. The time of onset of the west monsoon in various parts of Java is correlated with pressure at Kupang, Djakarta and Darwin taking into account the possibility of climatic changes. It is concluded that forecasting of the time of onset of the monsoon should be based almost entirely uponpressure in the Darwin-Kupang region. *Subject Headings:* **1. Monsoon forecasting 2. Java.**—*I.L.D.*

4.1–66 551.509.33:551.577.33

Rosenan, Naftali, **Long range forecasts of rainfall.** *Research Council of Israel, Bulletin*, 1(1/2):33–35, March **1951.** 3 refs. Abstracted from reprint. **DWB**—The forecasting of winter rainfall in Israel is based upon the meridional displacement of the anticyclonic cell in the Middle East during late summer. Taking the Sudanese rainfall data for late summer from 1924–1949 and 1942–1949 for correlations between actual and forecast rainfall, a significant negative correlation was established between eight Sudanese stations distributed along a meridian and four stations in Israel during the following winter. *Subject Headings:* **1. Long range forecasting 2. Rainfall variations 3. Israel.**—*I.L.D.*

4.1–67 551.509.33:551.524.37

†Sinz, H., **Zum Problem der europäischen Strengwintern.** [On the problem of severe winters in Europe.] *Zeitschrift für Meteorologie*, 6(3):82–88, March **1952.** 3 figs., 22 refs. **MH-BH**—A summary of recent literature bearing on the problem of forecasting the winter, with special reference to 1946–47. Includes pressure anomalies, periodicities, 500 mb topography, displacement of pressure centers and effect of Arctic ice. *Subject Headings:* **1. Long range forecasting 2. Severe winters 3. Europe.**—*C.E.P.B.*

4.1–68 551.509.54

Sekine, Y., **On some investigations for the rainfall forecast in Fukushima Region.** *Society for the Long-Range Forecast Research of Tohoku District, Journal*, 11(1):13–18, March **1951.** tables, graphs, diagrs. In Japanese, English summary p. 52; headings in English. **DWB**—Author tabulates for each season statistics of intervals between rain at Saishu and Fukushima due to travelling depressions. He then considers relation between weather at Fukushima and pressure differences or location of cyclone center; the latter gives a method of forecasting beginning of rain. *Subject Headings:* **1. Rainfall forecasting 2. Japan.**—*C.E.P.B.*

4.1–69 551.509.58:551.579.4:627.1

King, Ralph E., **Stage predictions for flood control operations.** *American Society of Civil Engineers, Proceedings*, v. 77, Separate No. 79, July **1951.** 9 p. 5 figs., 2 tables, 7 refs. Abstracted from reprint. **DWB**—The author discusses the principles of stage forecasting of floods, the development of single line curves and multiple line charts and the application of this technique in forecasting floods on the lower Mississippi, in particular to reaches that are influenced by inflows from major tributaries. It is concluded that reliable forecasts cannot be

made for the lower Mississippi by means of any rigid formula, that procedures to be reliable must evaluate the effects of current channel conditions, tributory flows, storage and precipitation, and that procedures based upon volumetric analysis give better results than those based on stage heights. *Subject Headings:* **1. Flood forecasting 2. Water level variations 3. River stages 4. Lower Mississippi River.**—*I.L.D.*

CLOUD SEEDING AND ARTIFICIAL PRECIPITATION

See also: Snow and its relation to experimental meteorology (Schaefer), 4.1–7.

4.1–70 551.509.67:551.578.7

Dessens, Henri (*Dir. Puy-de-Dôme Obs.*), **Les Pyrénées, laboratoire de météorologie expérimentale.** [The Pyrenees, laboratory of experimental meteorology.] *Pyrénées*, No. 7, [1951]. 4 p. Stamped on title page: *Puy-de-Dôme. Observatoire, Publications, Ser. B*, No. 4, **1951.** Abstracted from reprint. **DWB**—In this preliminary account of an artificial rain making and hail prevention project sponsored by the Regional Commission of anti-hail technical research of southwestern France and the Electrical Administration of France, experiments carried on with AgI generated on the ground and with salt crystals introduced into clouds from stations at high altitudes (1800–2900 m) are reported. The experiments were based on theories and results reported by American scientists, especially those connected with Project Cirrus. It is pointed out that no final conclusions can be drawn at this early stage of the enterprise. A few experiments are described but no conclusive evidence is offered. *Subject Headings:* **1. Hail prevention 2. Artificial precipitation 3. Silver iodide smoke generators 4. Cloud seeding 5. Pyrenees 6. Southwestern France.**—*G.T.*

4.1–71 551.509.67

Krick, Irving P. and Smith, T. B., **Some evaluations of sustained cloud-seeding operations.** *American Geophysical Union, Transactions* 33(1):53–56, Feb. **1952.** 7 figs., 2 tables. **DWB**—Evaluation of silver iodide cloud seeding experiments carried out during July to December 1950 in various western sections of the United States. Comparison of the precipitation with unseeded control areas is made by means of correlations. Except for one case, the precipitation in the target area was higher than in the control areas; but the results are within limits of error, except in July 1950 in New Mexico. It is possible that cloud seeding not only increases the total rainfall amount, but also distributes rainfall more uniformly over wide areas. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Rainfall distribution 4. Silver iodide 5. Western United States.**—*A.A.*

4.1–72 551.509.67:551.574.1

Neumann, H., **Silver iodide as a cloud seeding agent.** [In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 24–29. 7 refs. In Hebrew, English summary p. 9–10.] **DWB**—WEGENER's, FINDEISEN's and BERGERON's theory of colloidal instability of supercooled clouds, SCHAEFER's work of inducing artificially ice crystals in a supercooled cloud and CWILING and VONNEGUT's experiments with AgI are discussed. The results of experiments using a colloidal water suspension of AgI introduced into a cloud chamber (home freezer) are described. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. Silver iodide.**—*I.L.D.*

4.1–73 551.509.67

Zahavy, D., **Recent developments.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 60–63. 8 refs. In Hebrew, English summary p. 16–17.) **DWB**—VONNEGUT's AgI seeding experiments and the attitude of the American Meteorological Society towards rain making experiments are discussed briefly. Smoke generating activities from the ground were carried out in Israel in 1950–1951. Preliminary results indicate rainfall increase in the largest area. A single smoke generating operation from aircraft underneath a cumulus cloud was followed by heavy rainfall. *Subject Headings:* **1. Artificial precipitation 2. Silver iodide 3. Smoke 4. American Meteorological Society 5. Israel.**—*I.L.D.*

4.1–74 551.509.67

Zahavy, D., **Survey of research and experiments in artificial rain making.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 49–55. 23 refs. In Hebrew, English summary, p. 13–14.) **DWB**—A short description of the basic ideas on rain formation, a discussion of the action of AgI and of ice crystals in producing artificial rainfall and of the relationship of amount and type of precipitation to type of seeded clouds. *Subject Headings:* **1. Artificial precipitation 2. Rain formation 3. Silver iodide.**—*I.L.D.*

STRUCTURE AND PHYSICS OF THE ATMOSPHERE

STRUCTURE OF THE ATMOSPHERE

See also: Nitrogen in atmospheric precipitation (Ångström and Högberg), 4.1–1; Meteors as probes of upper atmos. (Whipple), 4.1–15; Chemical methods of measuring ozone (Teichert), 4.1–34; Energy diffused by a particle of volcanic dust (Vittozzi), 4.1–129; Measurements of parameters in theory of radio scattering in troposphere (Crain and Gerhardt), 4.1–271

4.1–75 551.510:551.507.362

Havens, R. J., Koll, R. T. and LaGow, H. E., (*U. S. Naval Res. Lab., Wash., D. C.*), **The pressure, density, and temperature of the earth's atmosphere to 160 kilometers.** *Journal of Geophysical Research*, 57(1):59–72, March **1952.** 7 figs., 4 tables, 13 refs. **MH-BH**—A program of pressure measurements with rockets over White Sands, N. Mex., and over the equator has given values for atmospheric pressure, density, and temperature from the ground up to 160 km above sea level. The data have been obtained from about a dozen rocket flights at White Sands, N. Mex., lat. 32°N, long. 106°W, and from one flight at the equator, long. 160°W. Measurements were made in every month except April, June and July. One rocket was flown at midnight, while the others were between 09^h00^m and 19^h00^m local time. Except for one daytime flight at White Sands, all the pressure data agree within the experimental errors. The fundamental data are pressures measured on the nose tips, nose cones, and tail section of V-2, Viking, and Aerobee rockets. From these measurements, atmospheric pressures, densities, and temperatures have been deduced. The pressure at 160 km is 2×10^{-6} mm of Hg, and the density is 1.5×10^{-6} gm/m³. The temperature reaches a maximum of 270°K at 50 km, a minimum of 190°K at 80 km, and increases to about 500°K at 160 km. *Subject Headings:* **1. Atmospheric structure 2. Structure of the stratosphere 3. Rocket soundings 4. White Sands, N. Mex.**—*Authors' abstract.*

4.1–76 551.510.3:551.501.7

Ashburn, Edward V., **An aid for computing the density of the upper atmosphere.** *Journal of Geophysical Research*, 56(4):563–565, Dec. **1951.** fig., 3 refs., 4 eqs. **MH-BH**—Combining the gas law and the hydrostatic equation, the author obtains a formula for computation of the density of the upper atmosphere at different levels, if the density at a certain level (for example 10 km) is known. *Subject Headings:* **1. Atmospheric density 2. Upper atmosphere.**—*A.A.*

4.1–77 551.510.3 551.521.31

Ashburn, Edward V. (*U. S. Naval Ord. Test Station, Inyokern, Calif.*), **The density of the upper atmosphere and the brightness of the twilight sky.** *Journal of Geophysical Research*, 51(1):85–93, March **1952.** 5 figs., 2 tables, 25 refs. **MH-BH**—The intensity of the zenith skylight was measured for solar zenith angle of 90° to 106° for wave-length of 0.75μ, 0.52μ and 0.44μ. The polarization was measured for the 0.44μ region. The difference between the measured polarization and the computed polarization of the primary scattered light was used to determine the fraction of the total zenith skylight that was due to primary scattering. The equation relating the atmospheric molecular density to the intensity of the primary scattered zenith skylight contains an extinction term. It was shown that the extinction term can be evaluated most accurately for the blue light. The computed atmospheric molecular densities agree with those by the N.A.C.A. tentative standard atmosphere. *Subject Headings:* **1. Atmospheric density 2. Twilight sky brightness.**—*Author's abstract.*

4.1–78 551.510.41:546.214 551.508.95

Alaska. University. Geophysical Institute, **State of the earth's atmosphere in the Arctic.** Contract AF19(122)-479, Progress Report, No. 1, Aug 15, **1951.** 19 p. tables, diagrs. **DWB**—Pt. 1. "The chemical determination of the amount of ozone in the air at the earth's surface at College, Alaska" by ROBERT D. LOWREY and GEORGE THIRTLE, consists of a discussion of the use of thiosulphate as a chemical reagent of ozone, of the inherent indeterminate errors present in this method and of the results of experiments in which the effect of the hydrogen ion concentration, the effect of distilled water and that of a buffer upon the action of the thiosulphate was tested. Pt. 2. "The searchlight technique for exploring the atmosphere" by JACK KATZENSTEIN, describes an attempt to test the validity of the method (developed by the author) of evaluating the signal produced by light scattering from the noise background. Experimental results indicate that the signal due to light scattering is given by the expression $S=\sqrt{S^2_R-S^2_N}$ where S_R = total signal received and S_N = the noise signal and S = signal due to light scattering alone. Pt. 3. "Ionization chamber" by JACK KATZENSTEIN, contains a description and diagrams of an ionization chamber for correlating total cosmic ray intensity with auroral or geomagnetic activity. *Subject Headings:* **1. Chemical ozone determination 2. Searchlight soundings 3. Ionization chambers 4. College, Alaska. I. Contract AF19(122)-479 II. Lowrey, Robert D. III. Thirtle, George IV. Katzenstein, Jack.**—*I.L.D.*

4.1–79 551.510.41:546.214 551.508.95

Alaska. University. Geophysical Institute, **State of the earth's atmosphere in the Arctic.** Contract AF19(122)-479, Second and Final Report, Nov. 15, **1951.** 25 p. figs., tables, refs., eqs. **DWB**—Contains the following papers: MUKERJEE, N. R. and GUENTHER, W. B. "The chemical determination of ozone in the air at the earth's surface at College, Alaska." The thiosulphate and arsenite methods were used determining the average daily values of ozone concentration in the atmosphere. Data are given for ozone concentration, temperature and pressure from Aug. 1 to Oct. 31, 1951. The authors consider the arsenite method more reliable. BETTLER, PHILIP C. "The searchlight technique for exploring the atmosphere." An outline of the theory is given and the apparatus used described. Results for three nights are presented graphically. The observed air density agrees fairly well with the tables of G. GRIMMINGER (*see item* 8–31, Aug. 1950, *MAB*). BETTLER, PHILIP C. and POPE, JOSEPH H. "Ionization chamber." A continuously recording system is described. The apparatus will be tested. *Subject Headings:* **1. Chemical ozone determination 2. Searchlight soundings 3. Ionization chambers 4. College, Alaska. I. Mukerjee, N. R. II. Guenther, W. B. III. Bettler, Philip C. IV. Pope, Joseph H. V. Contract AF19(122)-479.** —*A.A.*

4.1–80 551.510.41:546.214(794)

Bartel, A. W. and Temple, J. W. (*U. S. Rubber Co.*), **Ozone in Los Angeles and surrounding areas.** *Industrial and Engineering Chemistry*, 44(4):857–861, April 2, **1952.** 8 figs., 3 tables, 13 refs. **DLC**—An apparatus based on the absorption of ozone by potassium iodide, was used for measuring ozone content at Los Angeles and vicinity. Data on ozone equivalent for 1949–1951 are presented in tables and graphs and compared with data on maximum temperature and relative humidity. A comparison with ozone equivalent data from other locations in the U. S. show that amounts at Los Angeles and vicinity are relatively high. It is found that amounts for the city area show agreement with results obtained at non-city stations and the hypothesis of an effect due to special components of the city atmosphere is dismissed. *Subject Headings:* **1. Ozone variations 2. Ozone measurement 3. Los Angeles, California.**—*G.T.*

4.1–81 551.510.42:581.055

Adams, Donald F.; Mayhew, Delbert J.; Gangy, Richard M. and others (*State College of Washington, Pullman, Wash.*), **Atmospheric pollution in the ponderosa pine blight area, Spokane County, Washington.** *Industrial and Engineering Chemistry*, 44(6):1356–1365, June **1952.** 18 figs., 3 tables, 13 refs. **DLC**—The reddening of needles of ponderosa pine trees in the industrial area north of Spokane, Wash. observed since 1943, has been investigated.

The damage is attributed to gaseous fluorine and sulfur compounds found in the air during the growing season. The effect of inversion layers and of wind (modified by topography) on the concentration of these gases is discussed. Distribution of inversions from 1944 to 1949 and average wind direction frequency from April to October 1950 are shown in graphs. Data on concentrations of fluorine compounds with accompanying meteorological conditions are presented. *Subject Headings:* **1. Atmospheric pollution 2. Forests 3. Ponderosa pine 4. Spokane County, Washington. I. Richey, Eugene P. II. Koppe, Robert K. III. Allen, Ivan W.**—*G.T.*

4.1–82 551.510.42:551.588.7

Flach, E. and Würfel, H., **Zur Kenntnis der lufthygienischen Eigenschaften Berlins und seiner Randgebiete.** [On the knowledge of the hygienic characteristics of the air of Berlin and its neighborhood.] *Angewandte Meteorologie*, 1(6):161–169, June **1952.** 3 figs., 9 refs. **DWB**—Continuous counts of nuclei were made in center of Berlin, on northern edge and in northern outskirts, in Oct. 1951. Diagrams, especially relating to clear days, show the effect of wind direction and vertical currents on the diurnal variation of the distribution of gases from heavy industry. Rapid variations, termed *Kernböigkeit* ("nuclear gustiness") are discussed in detail and are associated with variations of convection and turbulence. *Subject Headings:* **1. Atmospheric pollution 2. Urban influences.**—*C.E.P.B.*

4.1–83 551.510.42

Gosline, C. A. (*DuPont*), **Meteorology applied to air pollution abatement.** *Meteorological Monographs*, Boston, 1(4):4–5, Nov. **1951. MH-BH**—Meteorological control of atmospheric pollution from industrial operations represents only one of three methods of control, and is not reliable 10% of the time because of forecast errors, because not applicable to continuous operation, is not usually economical, and can only be applied to single plants in isolated areas. *Subject Headings:* **1. Atmospheric pollution control 2. Smoke abatement.**—*M.R.*

4.1–84 551.510.42

Haagen-Smit, A. J. (*Calif. Inst. of Technology*), **Chemistry and physiology of Los Angeles smog.** *Industrial and Engineering Chemistry*, 44(6):1342–1346, June **1952.** 3 figs., table, 17 refs. **DLC** -Harmful effects of air pollutants in the Los Angeles area, namely: decrease in visibility, crop damage, eye irritation, odor nuisance and rubber cracking were investigated and traced back to the presence of an oxidant (oxygen, atomic oxygen and ozone) which "reacts with hydrocarbons and their oxidation products, producing peroxides and further degradation products." Data on rubber cracking, crop damage and eye irritation are graphically compared with various chemicals found in the atmosphere. *Subject Headings:* **1. Atmospheric pollution 2. Atmospheric pollution effects 3. Smog 4. Los Angeles, Calif.** —*G.T.*

4.1–85 551.510.5

*Dupont, Geneviève and Grosjean, Pierre V., **Atmosphère standard provisoire pour le Congo.** [Provisional standard atmosphere for the Congo.] *Belgian Congo. Service Météorologique, Bulletin*, No. 7:9–32, July **1951.** tables, graphs, 7 refs. In French; summaries in French, Dutch, English and German p. 9–10. **DWB**—Data on real and virtual temperature obtained over Elisabethville in Feb. 1951 are presented in tables and graphs and compared with similar data obtained at the same time at Leopoldville. Discrepancies which are noticeable in higher altitudes between the two sets of measurements are attributed to the fact that Canadian instruments used in Leopoldville were more readily influenced by the Lugeon effect than the Finnish equipment used in Elisabethville. A tentative standard atmosphere is established by means of adjustment of three converging polytropes (real temperature for low and high levels and virtual temperature for high levels). A basic statistical method was used in making the adjustment. The theoretical background of this method is explained by GROSJEAN in an appendix to the article. *Subject Headings:* **1. Standard atmosphere 2. Radiosonde data 3. Belgian Congo.**—*G.T.*

UPPER ATMOSPHERE-IONOSPHERE

See also: Ionospheric wind measurements at 150 Kc/s (Millman), 4.1–156; Polarization of radio waves reflected from ionosphere (Landmark), 4.1–273

4.1–86 551.510.53

Alter, Dinsmore (*Griffith Observatory, Los Angeles*), **The upper atmosphere of earth.** *The Griffith Observer*, Los Angeles, 16(4):38–43, April **1952.** 2 figs., 5 tables. **DWB**—This paper gives a summary of a report, edited by N. C. GERSON, on a colloquium held at the Air Force Cambridge Research Center in July 1950. Current knowledge of the stratification of the atmosphere, of chemical constituents, of temperature, pressure, density and mean free path and of magnetic and optical phenomena is discussed in nontechnical terms and some of the tables and diagrams contained in the original report reproduced. *Subject Headings:* **1. Upper atmosphere research. I. Gerson, N. C.**—*G.T.*

4.1–87 551.510.53:535.33

Blamont, Jacques-Émile and Kastler, Alfred, **Réalisation d'un photomètre photoélectrique pour l'étude de l'émission crépusculaire de la raie D du sodium dans la haute atmosphère.** [Construction of a photoelectric photometer for the study of the crepuscular emission of the D band of sodium in the upper atmosphere.] *Annales de Géophysique*, 7(2):73–89, April/June **1951.** 11 figs., 2 tables, 18 refs., eqs. French and English summaries p. 73. **MH-BH**—A photoelectrical photometer, sensitive to D_1 and D_2 lines only, was used to study the sodium crepuscular emission and to deduce the altitude distribution of emitting atoms between 100 and 200 km. This distribution does not seem to be exponential. *Subject Headings:* **1. Photoelectric photometers 2. Sodium emission 3. Upper atmosphere.**—*Authors' abstract.*

4.1–88 551.510.535:551.594.6:621.396

Caton, P. F. G. and Pierce, E. T., **The waveforms of atmospherics.** *Philosophical Magazine*, London, Ser. 7, 43(339):393–409, April **1952.** 14 figs., table, 14 refs., 4 eqs. **DWB**—A number of waveforms observed at Cambridge, Eng., are illustrated, and the technique of photography is described. The forms are classified into 8 types, their occurrence described and origin discussed (initial leader, return strokes, etc.). The theory of multiple ionospheric reflections is considered; about 10% of the records give precise values of the height (about 85 km) and distance of reflection. *Subject Headings:* **1. Sferics 2. Ionospheric reflection 3. Cambridge, England.**—*C.E.P.B.*

4.1–89 551.510.535:551.594.7:621.396

Gerson, N. C., **Abnormal E region ionization.** *Canadian Journal of Physics*, 29(3):251–261, May **1951.** 10 figs., 12 refs. **DWB**—The occurrence and sweep of sporadic E over North America was studied with the cooperation of radio amateurs transmitting in the frequency range 50–54 mc/sec. The movement and geographical extent of the reflection areas were determined by oblique incidence radio observations. The behaviors of two sporadic E centers observed on June 13, 1949 are described. *Subject Headings:* **1. Sporadic E layer 2. Ionosphere 3. Ionization band echoes 4. Radio wave reflection 5. North America.**—*T.L.D.*

4.1–90 551.510.535

Peterson, Allen M., **The mechanism of F-layer propagated back-scatter echoes.** *Journal of Geophysical Research*, 56(2):221–237, June **1951.** 8 figs., 10 refs., 15 eqs. **MH-BH**—Observed back scatter from the F layer (2F) is difficult to explain on the basis of its origin in the E layer, but agrees with theory if it is assumed that the scattering occurs at the earth's surface. This type of scattering is not unusual or sporadic but occurs nearly 100% of the time. The leading edge of the pattern is sharply defined. The time delay as a function of frequency and transmitter power or pulse width is investigated and the results shown graphically and explained. *Subject Headings:* **1. F layer scattering 2. Radio wave propagation.**—*M.R.*

MECHANICS AND THERMODYNAMICS OF THE ATMOSPHERE

See also: Dynamics of stationary atmospheric pressure fields (Hollmann), 4.1–4; Large-scale aspects of energy transformation over oceans (Jacobs), 4.1–5; Horizontal circulation of air during passage of frontal zone (Bultot), 4.1–116; Heat balance measurements (Deij), 4.1–117; Bibliography on the theory of turbulence, 4A–1 to 4A–205

4.1–91 551.511

Dufour, Louis (*Inst. Royal Met. de Belgique*) and Defay, R. (*Univ. de Bruxelles*), **Extension du théorème de Duhem en vue des applications à la thermodynamique de l'atmosphère.** [Extension of Duhem's theory for the purpose of applications to the thermodynamics of the atmosphere.] *Journal Scientifique de la Météorologie*, 4(13):1–4, Jan./March **1952.** 8 eqs. French, English and Spanish summaries p. 1. **DWB**—DUHEM's theorem is extended to allow the determination of the number of independent variables which determine the state of equilibrium of a closed capillary system composed of solid phases separated by curved interfaces. The solution for complete determination gives the formula $1+\phi+\psi$ independent variables. The special cases for spherical drops and for intensive and extensive variables are treated. In practice, some of the independent variables (such as pressure) may be ignored if necessary when making calculations of thermodynamics of drops. Temperature cannot be ignored unless kept constant. *Subject Headings:* **1. Thermodynamics of the atmosphere 2. Evaporation of water drops.**—*M.R.*

4.1–92 551.511:551.513.1

Eliassen, Arnt, **Slow thermally or frictionally controlled meridional circulation in a circular vortex.** *Astrophysica Norvegica*, 5(2):19–60, May **1952.** 17 figs., 12 eqs. **DWB**—A quasi-static theory of meridional motion in a stable circular vortex, caused by sources of heat or angular momentum, is developed. The stream function of the meridional motion is found to satisfy a generalized Poisson equation in the meridional plane. In the vicinity of a point-source of angular momentum, the field of meridional motion is shown to have the character of a distorted field of a dipole, with elliptical streamlines. It is found that the meridional motion will take place mainly in the directions where stability of the vortex is smallest, and that the speed of the meridional circulation, for given sources of heat or angular momentum, will increase with decreasing stability of the vortex. The accompanying changes in the kinematic energy of the vortex motion, and of the vortex structure, are discussed. An attempt is made to apply the theory to possible meridional currents in the earth's atmosphere. *Subject Headings:* **1. Meridional circulation 2. Circular vortexes 3. Dynamics of the atmosphere 4. Angular momentum balance.**—*Author's abstract.*

4.1–93 551.511:551.524.4:551.543

Fleisher, Aaron, **On the diabatic flow of a compressible fluid.** Massachusetts Institute of Technology, Contract N5ori-07804, Research on Atmospheric Pressure Changes, Technical Report No. 8, Feb. 1, **1951.** 49 p. 13 figs., 20 refs., 7 eqs. **DWB**—A study of the influence of nonadiabatic temperature changes on pressure changes. Separate chapters take up the solution of hydrodynamic equations for 1) the thermodynamics and orderliness of motion *with* friction, 2) the dynamical effects of heating on horizontal motion and 3) the external heat exchanges required by a three-dimensional motion. Although admittedly the models constructed here bear no relation to those in the atmosphere (thunderstorm cells, thermal flows or land and sea breezes), since density is neglected, several conclusions are reached which contradict former notions on thermodynamic processes in heat sources and sinks. *Subject Headings:* **1. Diabatic flow 2. Thermodynamics of the atmosphere 3. Heat sources and sinks. I. Contract N5-ori-07804 II. Massachusetts Institute of Technology.**—*M.R.*

4.1–94 551.511

Høiland, Einar, **On horizontal motion in a rotating fluid.** *Geofysiske Publikasjoner*, 17(10), **1950.** 26 p. 20 figs., 9 refs., 7 eqs. **MH-BH**—The earth's rotation gives rise to an induced circulation and an induced vorticity. The effect of the latter on motion in steady cyclones and anticyclones is examined. Steady cyclones have the most intense motion south of their centers. Some properties of moving horizontal whirls are discussed. Exact steady

solutions for the differential equation of the induced vorticity are given. The author presents also a solution for the distribution of the winds in the upper troposphere. This solution shows strong easterlies from the pole to $\phi = 54°$, with the greatest intensity at 70°, weak easterlies in the tropics to 8°, and westerlies from 8 to 54°, a very approximate agreement with results of observations. The author believes that better agreement would be attained if the assumption was made that the magnitude $2\omega \sin \phi$ in one of the basic equations is reduced considerably by friction. Instability waves and waves in a rectangular basin are also examined. *Subject Headings:* **1. Dynamic meteorology 2. Horizontal motion 3. Vorticity.**—*A.A.*

4.1–95 551.511:551.513.1

§Mironovitch, I. V., **Perturbations troposphériques et substratosphériques. Leur indépendance. Structure de l'atmosphère libre lors de leur passage. Étude statistique et synoptique.** [Tropospheric and substratospheric disturbances; their independence. Structure of the free atmosphere during their passage; statistical and synoptic study.] *France. Office National Météorologique, Mémorial*, No. 32, **1949.** 97 p. charts, diagrs., tables, refs. **MH-BH**—This is a comprehensive statistical and synoptic study of the tropospheric and substratospheric disturbances of temperature and pressure. It aims to prove the independence of these two types of disturbances and to examine the structure of the atmosphere during their passage. The following facts have been established: a dividing of the pressure wave as it progresses upward from the ground into the troposphere; the symmetry of baric and thermic oscillation during a tropospheric disturbance and the close relationship of these phenomena; the absence of any correlation between disturbances of substratospheric pressure and cloud systems; and the absence of sustained oscillations in the substratosphere. *Subject Headings:* **1. Atmospheric disturbances 2. Troposphere 3. Substratosphere 4. Synoptic studies 5. Atmospheric structure.**—*I.L.D.*

4.1–96 551.511

Čadež, Marjan, **O specifičnoj toploti vazduha.** [On the specific heat of air.] *Yugoslavia. Hidrometeorološka služba. Hidrometeorološki Glasnik*, 3:13–18, **1950.** 2 refs., eqs. In Serbian, French summary p. 17–18. **DWB**—A mathematical analysis of the specific heat of air at constant volume and constant pressure is offered. It is shown that the change in pressure of water vapor as a function of changes in temperature is in close relationship with the absorption or release of the heat of evaporation. The author distinguishes between positive and negative specific heat, i.e., the increase or decrease in heat which will change the temperature of a unit of humid air mass by one degree. *Subject Headings:* **1. Specific heat of air 2. Thermodynamics of the atmosphere.**—*G.T.*

4.1–97 551.511:551.515.81

Bultot, F., **Sur la courbure des surfaces de discontinuité de l'atmosphère.** [On the curvature of atmospheric discontinuity surfaces.] *Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, Brussels, Bulletin de la Classe des Sciences*, 5 Ser., 37:977–985, 1081–1092, **1951.** figs., eqs. Abstracted from reprint. **DLC**—In this highly mathematical paper, the mean curvature of a surface of discontinuity is expressed as a complex of the conditions immediately on either side of it. The mean curvature is related to the curvature of the isohypses and lines of greatest slope of the surface. The results are applied to frontal surfaces in the form of parts of cylinders, separating warm and cold air masses. *Subject Headings:* **1. Dynamic stability 2. Frontal structure.**—*C.E.P.B.*

GENERAL CIRCULATION

See also: Slow thermally or frictionally controlled circulation in circular vortex (Eliassen), 4.1–92; Tropospheric substratospheric disturbances . . . (Mironovitch), 4.1–95

4.1–98 551.513.1

James, R. W., **The structure of mean circulation.** *Tellus*, 3(4):258–267, Nov. **1951.** 9 figs., 5 eqs., 8 refs. **MH-BH**—The mean geostrophic circulation as a function of latitude and the vertical profile of momentum is examined. Special attention is turned to the jet

phenomenon. The vertical wind profile is calculated. The geostrophic wind in the free atmosphere has a well expressed annual variation. Conditions on other longitudes are compared with the data obtained over North America. *Subject Headings:* **1. General circulation 2. Pressure distribution.**—*A.A.*

4.1–99 551.513.2:551.509.31

Obuljen, A., **O položaju našeg užeg sinoptičkog područja u odnosu na evropsko deformaciono polje.** [On the relation of our region to the European deformation field.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorološki Glasnik*, 3:57–60, 1950. 2 figs., 10 refs. In Croatian. **DWB**—Frontal zones over the Atlantic and over Europe are discussed in reference to T. BERGERON's pattern. The importance of a clear understanding of deformation fields in general circulation as a basis for synoptic studies, for constructing weather charts and for preparing short range and long range weather forecasts is stressed. *Subject Headings:* **1. Deformation fields 2. Synoptic analysis 3. General circulation 4. Synoptic forecasting 5. Yugoslavia.**—*G.T.*

4.1–100 551.513.7(52)

Seo, T., **Circulation in early summer, May and June 1950.** *Journal of Meteorological Research, Tokyo*, 3(9):332, July **1951.** 3 figs. In Japanese. **DWB**—Isopleths of surface pressure; 700 mb zonal westerlies along 130°E; and deviations of temperature and precipitation at Sapporo are correlated graphically and discussed. *Subject Headings:* **1. Circulation anomalies 2. Sapporo, Japan.**—*M.R.*

ATMOSPHERIC DISTURBANCES

See also: Dynamics of stationary atmospheric pressure fields (Hollman), 4.1–4; Curvature of atmospheric discontinuity surfaces (Bultot), 4.1–97; Rainfall near center of high pressure area (Van Ufford), 4.1–187; Green sky around dusk (Thomas), 4.1–258

4.1–101 551.515.12:551.577.3:551.578.45(74)

§Carr, J. A. (*U. S. Weather Bureau, Wash., D. C.*), **The precipitation pattern associated with an Atlantic coastal storm.** *Monthly Weather Review*, 80(2):31–35, Feb. **1952.** 7 figs., ref. **DWB**—The progress of a storm along the Atlantic coast is followed up from its origin in the western Gulf of Mexico on Feb. 25, 1952 until its final and strongest phase at Cape Cod, Mass. on Feb. 28–29. The synoptic development is described and illustrated with regard to the surface, 700-mb and 500-mb situations. Features of a marginal snow forecasting problem for Washington, D. C. and of an all-time record snowfall at Nantucket, Mass., are discussed in particular. A storm track and a precipitation chart for the 5-day period and surface and 700-mb charts for Feb. 27 are presented. These latter show the critical situations when precipitation occurred near the District and when the deepening storm approached Cape Cod. *Subject Headings:* **1. Coastal storms 2. Cyclone tracks 3. Synoptic studies 4. Snowstorms 5. Snow forecasting 6. Atlantic Coast.**—*G.T.*

4.1–102 551.515.2(261)

§Bailey, Morton H. (*Fla. State Univ.*), **The Atlantic hurricane of May 1951.** Florida. State University. Dept. of Meteorology, Contract Nonr-158(00), Technical Report, March 1, **1952.** 13 p. 18 charts, 21 refs. **DWB**—A synoptic analysis of an unusual hurricane, unusual because of the high latitude and early season of its origin. The meteorological conditions observed shortly before and during the existence of this storm are described. The hurricane was observed first at 30°N and 65°W, moved down to Florida and only then northwards to Cape Hatteras. *Subject Headings:* **1. Hurricanes 2. Florida 3. Atlantic Ocean. I. Florida. State University. Dept. of Meteorology II. Contract Nonr-158(00).**—*A.A.*

4.1–103 551.515.2:550.34:551.465

Donn, William L., **An investigation of swell and microseisms from the hurricane of August 13–16, 1946.** Columbia University. Lamont Geological Observatory, Contract AF19(122)-441 and Contract N6-onr-27133, Technical Report No. 17, Oct. **1951.** 8 p. 3

graphs, 7 refs. **DWB**—The observed lack of relationship between the period of swell and microseisms associated with the same storm seems to indicate that the microseisms are not caused by the swell. It appears that the microseism origin may lie "in the area directly beneath the storm and result from some coupling mechanism at the water-air interface." *Subject Headings:* **1. Hurricanes 2. Microseisms 3. Swell 4. Ocean-atmosphere interaction. I. Columbia University. Lamont Geological Observatory II. Contract AF19(122)-441 III. Contract N6-onr-27133.**—*M.P.K.*

4.1–104 551.515.2(26):656.608(52)

Oka, T., Kasamura, Y. and Tabata, S., **A meteorological study on ship disasters in the Bungo Canal.** *Journal of Meteorological Research*, Tokyo, 3(4):109-120, March **1951.** 16 figs., 6 tables. In Japanese, English summary p. (9). **MH-BH**—Synoptic situations affecting navigation are investigated by means of a statistical approach. Types of typhoon, cyclone, pressure pattern and fog which usually cause accidents are determined. Data for distribution of accidents in time and space, weather charts showing critical synoptic situations, curves on the relation between wind velocity over land and sea and on damage as a function of maximum wind velocity, a table of monthly mean frequency of dense fog and a table showing criteria for storm warning are presented. *Subject Headings:* **1. Marine meteorology 2. Marine disasters 3. Typhoons 4. Storm warnings 5. Bungo Canal, Japan.**—*G.T.*

4.1–105 551.515.21

Hashimoto, M. and Sampei, J., **On the analysis of the typhoon Kitty.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(8):255–265, Aug. **1951.** figs., tables, refs. In Japanese, English summary p. 264–265. **MH-BH**—The typhoon of Aug. 30-Sept. 1, 1949, was analyzed by vertical cross sections of pressure and potential temperature and by time-pressure profiles. The distribution of pressure and temperature at levels up to 18 km, and of tropopause height, is sketched. Pressure is lowest in the center up to 6 km; low then shifts to SW and at 15 km high pressure is found at and in front of center. Temperature is low in center up to 3 km, then becomes high; temperature distribution is dynamical. Near the center the tropopause is high and warm, behind it low and cold. *Subject Headings:* **1. Typhoon structure 2. Typhoon "Kitty" (1949).**—*C.E.P.B.*

4.1–106 551.515.23

Rodewald, Martin, **Ein tropischer Wirbelsturm überholt einen anderen.** [One tropical hurricane overtakes another.] *Wetterlotse*, Hamburg, No. 28/29:4–7, Oct. **1951.** 2 figs. **DWB**—In N. Atlantic the hurricane of Sept. 4–15, 1951, was overtaken and passed by that of Sept. 6–11, which followed a track a little to the E. The earlier travelled very slowly on an acute recurve, the later one was slowed down only slightly on a more open recurve. It gave winds up to 140 knots. *Subject Heading:* **1. Hurricane tracks.**—*C.E.P.B.*

4.1–107 551.515.3:632.187

Graham, Howard E. (*U. S. Weather Bureau, Portland, Ore.*), **A fire-whirlwind of tornadic violence.** *Weatherwise*, 5(3):59, 62, June **1952.** fig. **MH-BH**—The fire whirlwind described was observed on Aug. 23, 1951 during the Vincent Creek fire in northwest Oregon. Violent whirling surface winds were observed over a diameter of 100 to 200 feet with a dark tornado-like tube extending upward. The meteorological condition was one of conditional instability; temperature of 67°F, relative humidity of 46% and wind velocities of 10–15 mph at ridge top and 8–16 mph up to 10,000 ft were recorded. The possible cause of a fire whirlwind is discussed and it is concluded that "the necessary factors seem to be for the fire to be on the lee slope sheltered from prevailing ridge-top winds, a moderate or stronger wind at the ridge top and strong converging surface updraft currents along the burning or sunheated slopes." A diagram of the fire whirlwind is presented. *Subject Headings:* **1. Whirlwinds 2. Forest fires 3. Orographic influences 4. Oregon.**—*I.L.D.*

4.1–108 551.515.3:551.556.1(43)

Klauser, Leopold, **Die Trombenerscheinungen bei Potsdam am 26.6.1951.** [Tornadoes near Potsdam on June 26, 1951.] *Zeitschrift für Meteorologie*, 6(5):151–155, May **1952.** fig.,

3 refs. **DWB**—Presents a detailed description of the tornado which was accompanied by water spouts and the damage it caused. The general weather situation that preceded and during the appearance of the tornado and the attendant aerological conditions, barometric pressure and wind velocity and direction, are described in detail. *Subject Headings:* **1. Tornadoes 2. Tornado damage 3. Waterspouts 4. Potsdam, Germany.**—*I.L.D.*

4.1–109 551.515.3:551.509.5:551.556.1(76)

Spring tornadoes and the tornado warning service. *Weatherwise*, 5(2):31, April **1952**. **MH-BH**—Brief description of the havoc caused by the tornado which struck the Mississippi Valley on March 21, 1952. The Weather Bureau Tornado Warning Service issued tornado warnings as a very active storm center began to move on a north-northeast track towards the Great Lakes. "Exceptionally cold air for the season lay to the west" at the same time that a "very warm moist air mass occupied the Gulf States." "The tornadoes as predicted occurred in the area just to the east of the cold front." *Subject Headings:* **1. Tornado damage 2. Tornado forecasting 3. Tornado tracks 4. Mississippi Valley. I. U. S. Weather Bureau. Tornado Warning Service.**—*I.L.D.*

4.1–110 551.515.4:621.396.9

Kessler, W. J. and Hersperger, S. P. (*Univ. of Florida, Gainesville*), **Recent developments in radio location of thunderstorm centers.** *American Meteorological Society, Bulletin*, 33(4) 153–157, April **1952**. 7 figs., 11 refs. **MH-BH**—The triangulation method of location of thunderstorms is described briefly with the aid of a diagram and an alternative single station method which is based on the analysis of the wave forms of atmospherics and which is unencumbered by communication difficulties between stations is presented. The single station technique is described with the aid of diagrams. The factors modifying the shape of the wave form during propagation and the assumptions underlying the ranging method which is based upon observations of time intervals are discussed. *Subject Headings:* **1. Thunderstorm location 2. Radio direction finders.**—*I.L.D.*

4.1–111 551.515.4:551.515.711(68)

Schaffer, W. (*Univ. of Cape Town, Rondebosch, South Africa*), **Second note on the thunderstorm high.** *American Meteorological Society, Bulletin*, 33(4):150–152, April **1952**. 2 figs. 3 refs. **MH-BH**—A theoretical analysis of the observed phenomenon of the sudden development of a region of a high pressure shortly before the onset of rain. The calculation of accelerational effect to explain this pressure increase is extended to include the associated change of density and an expression is developed showing that the change in surface pressure is nearly independent of the height at which acceleration takes place and depends only upon the change in velocity of vertical air streamlines. An hypothetical example of pressure change is analyzed. *Subject Headings:* **1. Thunderstorm dynamics 2. Anticyclogenesis 3. South Africa.**—*I.L.D.*

4.1–112 551.515.4:551.594.22:551.596.5(02)

Zim, Herpert Spencer, **Lightning and thunder.** Illus. by James Gordon Irving. New York, Morrow, **1952**. 58 p.+illus. **DLC**—An accurately written and cleverly illustrated book for Junior High School students or adults who wish to know the causes of convective clouds, thunderstorms, lightning (cloud-ground, beaded, ball, sheet), thunder, St. Elmo's fire, fulgurites, etc. Damage caused by lightning, precautions for people to take during a thunderstorm, and the principle of the lightning rod are discussed and illustrated. *Subject Headings:* **1. Thunderstorms 2. Lightning 3. Elementary textbooks 4. Juvenile literature. I. Irving, James Gordon (*illus.*).**—*M.R.*

4.1–113 551.515.

§Brunk, Ivan W., **Squall lines.** *Weatherwise*, 5(2):27–30, April **1952**. 3 figs. **MH-BH**—A nontechnical discussion of the characteristics of squall lines such as the associated weather, wind speeds, barometric changes and seiches; their movement, the incident degree of turbulence and time of occurrence. Also the relationship between squall lines and tornadoes is considered. A cross section drawing of the development of a squall line and synoptic charts of squall lines are given. *Subject Heading:* **1. Squall lines.**—*I.L.D.*

4.1–114 551.515.8:550.342

Donn, William L., **Frontal microseisms generated in the western North Atlantic Ocean.** *Journal of Meteorology*, 8(6):406–415, Dec. **1951.** 10 figs., 11 refs. **MH-BH**—Regular sinusoidal microseism trains associated with cold fronts over western N. Atlantic were compared with synoptic data; 6 are illustrated and discussed. It is concluded that microseisms are generated soon after a narrow frontal zone passes out to sea, period length increasing with depth of water. They are attributed to frontal fluctuations or turbulence, but may be maintained by gusty winds in cold sector. Wind waves, swell and surf are unimportant. *Subject Headings:* **1. Fronts 2. Microseisms 3. North Atlantic Ocean.** —*C.E.P.B.*

4.1–115 551.515.8:551.524.37

§Ooi, S., **Synoptic researches of winter weather of Japan (1st Report) (Inland high and local fronts).** *Journal of Meteorological Research*, Tokyo, 3(11):386–400, Sept. **1951.** 41 figs., refs. In Japanese, English summary p. (23)–(24). **MH-BH**—A detailed study of winds and weather over central part of Honshu, Japan, during cold wave of Jan. 20, 1941, illustrated by hourly (0–9h) local charts, isallobars and temperature changes and autographic records. The inland air cooled by radiation formed a local high with air flowing out down the valleys. This cold air formed fronts with warm moist sea air and local lows shown by changes of wind direction. Rainfall is combined frontal and orographic. Graphs for computing error of pressure reduction and change of wind direction are shown. *Subject Headings:* **1. Cold waves 2. Synoptic studies 3. Honshu, Japan.**—*C.E.P.B*

4.1–116 551.515.81:551.511

Bultot, F., **Circulation horizontale de l'air au passage d'une zone frontale.** [Horizontal circulation of the air during the passage of a frontal zone.] *Journal Scientifique de la Météorologie*, 3(12):113–123, Oct./Dec. **1951.** 4 figs., eqs., 4 refs. French, English and Spanish summaries p. 113. **MH-BH**—For the case of geostrophic wind, a formula is presented which is capable of explaining the variations in the horizontal circulation of the air crossing a frontal zone, taking into consideration only the field of the isobaric-isosteric solenoids. It is shown that this formula must be completed, in the case of the accelerated wind, by a new term depending mainly on the component, parallel to the front, of the rotational of acceleration of the air in the frontal zone. The interpretation of those formulae allows corroboration of the conclusions of E. Palmén, stating the possibility of the existence of an anticyclonic horizontal circulation of the air inside a frontal zone. *Subject Headings:* **1. Frontal circulation 2. Dynamics of the atmosphere.**—*Author's abstract.*

RADIATION AND TEMPERATURE

RADIATION

See also: Amendments to computation of radiation error of Finnish radiosonde (Raunio), 4.1–61; Density of upper atmos. and brightness of twilight sky (Ashburn), 4.1–77; Temp. of moon's surface (Wegener), 4.1–138; Water vapor content of atmosphere by dew- or frost-point measurement (Brewer), 4.1–160; Studies of twilight by scattering (Sato), 4.1–259

4.1–117 551.52:551.511:551.508.2

Deij, L. J. L., **Heat balance measurements.** *International Union of Geodesy and Geophysics, Association of Meteorology, Oslo 1948, Transactions*, v. 2, **1950.** p. 65–66. Mimeographed. **DWB**—The author summarizes the following papers of F. Albrecht on the heat balance of the earth's surface: "Untersuchungen über den Wärmehaushalt der Erdoberfläche in verschiedenen Klimagebieten" (in *Germany. Reichsamt für Wetterdienst Wissenschaftliche Abhandlungen*, 8(2) 1940), and "Der gegenwärtige Stand und die Aufgaben der Wärmehaushaltforschung" (in *Meteorologische Zeitschrift*, v. 60, 1943). Albrecht constructed an instrument for measuring the total radiational balance and designed a method for determining the heat flow into the earth. The measurements of the vertical temperature and vapor pressure gradients give the ratio $\frac{L}{V} = a\frac{\Delta\phi}{\Delta e}$ when factor $a = 0.482$. *Subject Headings:* **1. Heat balance**

measurements 2. Thermodynamics of the atmosphere 3. Radiation balance 4. Radiation instruments I. Albrecht, Fritz.—*I.L.D.*

4.1–118 551.521:551.508.2

Aizenshtat, B. A., **O neposredstvennom opredelenii komponent teplovogo balansa poverkhnosti zemli.** [On the direct determination of the components of heat balance of the earth's surface.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, Leningrad, No. 1:65–74, **1951.** 4 figs., table, 10 refs., 20 eqs. **DLC**—The basic principles of determination of the surface radiation balance by measuring the values of its components are set out. An apparatus is described for the measurement of the heat exchange between soil and air. A vacuum container with mirror surface has in the upper section a copper plate covered with oxide (giving great reflection of short wave radiation and great absorption of long wave). This plate is placed at the level of the soil. Thermometers are installed in the plate and on the soil surface. The compensation is produced by electrical currents from batteries. Description and calculation of observations made by means of this apparatus are presented and illustrated by empirical graphs. *Subject Headings:* **1. Soil-air heat exchange 2. Observation techniques 3. Radiation instruments.**—*N.T.Z.*

4.1–119 551.521:551.578.46:551.588.6

†Miller, David H., **Some forest influences on thermal balance over the snow pack.** Jan. 17, **1952.** 31 p. 5 figs., bibliog. p. 26–31. [Paper presented in Forestry 199, Fall 1951, University of California, Berkeley.] Typescript. **MH-BH**—Data on the transmission of radiation through forests of various trunk densities and through canopies of various densities, on interception of radiation and snowfall, on albedo of snowpack within the forest, on forest albedo, on heating of forest canopy by radiation, on long wave exchange between snow and canopy, etc., were collected from literature in forestry, botany and meteorology and particularly from reports (published and unpublished) of Cooperative Snow Investigations. An attempt was made to coordinate the material coming from various sources and the results are summed up and presented in graphical form. A bibliography of international literature containing 56 papers dealing with the subject is added. *Subject Headings:* **1. Thermal balance of snow 2. Forest radiation interception 3. Albedo of snow 4. Forest snow pack.**—*G.T.*

4.1–120 551.521.1:551.508.21(497.1)

*Savič, S. and Milosavljevič, K., **Intenzitet sunčevog zračenja u Beogradu.** [Intensity of solar radiation at Belgrade.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorološki Glasnik*, 1(1):53–59, Aug. **1948.** 4 figs., 2 tables. In Croatian. **DWB**—Tables of daily global intensity of solar radiation in cal/cm² and of daily sunshine duration in hours for the period April 1947–March 1948 and of monthly angles of incidence are presented and commented on. The data were obtained from recordings made with a Robitzsch-type actinograph at Belgrade. The instrument is described and shown in a drawing, its operation explained and the evaluation of data discussed. *Subject Headings:* **1. Radiation measurements 2. Sunshine duration 3. Robitzsch actinograph 4. Belgrade, Yugoslavia.**—*G.T.*

4.1–121 551.521.11(485)

Lindholm, Ferdinand (*Met. & Hydrol. Inst. Sweden*), **Sur la climatologie des rayonnements avec un aperçu de l'ensoleillement en Suède.** [On radiation climatology with a summary of insolation in Sweden.] *Séméiologie et Thérapeutique*, Dec. **1951.** unpaged. fig., 3 charts. Abstracted from reprint. **DWB**—Data on relative sunshine duration during April-Sept., Oct.–March and the whole year, and annual totals of sunshine duration are tabulated and presented graphically for 19 stations in Sweden for 1930–1949. Graphs of relative mean sunshine duration and cloudiness are presented for Stockholm for the years 1905–1949. Comments on the method used in coordinating the data are added. *Subject Headings:* **1. Sunshine duration 2. Cloudiness 3. Radiation climate 4. Stockholm 5. Sweden.** -*G.T.*

4.1–122 551.521.13

Nicolet, Marcel, **Sur le problème de la constante solaire.** [On the problem of the solar constant.] *Annales d'Astrophysique*, Paris, 14(3):249-265, July-Sept. **1951.** 6 figs., 8 tables,

3 refs. Also: *Belgium. Institut Royal Météorologie, Contribution*, No. 3, **1951.** **DWB**—A determination of the spectral distribution of the solar radiation is given on the basis of observations of the solar continuum and the absorption by Fraunhofer lines. The ultraviolet and infrared corrections suggested by SCHATZMAN and ALLEN and those adopted by ABBOT are compared. The mean value of the solar constant should be corrected to allow for the exact spectral distribution between 1μ and 2μ, where the more important correction appears. If a value of 1.94 cal-min^{-1}-cm^{-2} is assumed for the standard value of the Smithsonian Institution, a new estimate of the solar constant gives 1.98 cal-min^{-1}-cm^{-2}. However an absolute value must be given by new absolute measurements of the solar emission in certain spectral ranges or by direct measurement by rockets. The error of the solar constant is probably not less than $\pm 5\%$. *Subject Heading:* **1. Solar constant.**—*Author's abstract.*

4.1–123 551.521.2

Lönnqvist, Olov, **On the effective radiation to various parts of a cloudless sky.** *Tellus*, (3):148–153, Aug. **1951.** 2 figs., 3 tables, 11 refs., 10 eqs. **MH-BH**—The empirical formula of LINKE and of SÜSSENBERGER and that of the author for calculating relative radiation at any zenith distance (relative radiation being defined as the ratio between the effectual radiation, various parts of a cloudless sky and the earth's black body radiation) are presented. From his own formula for relative radiation as a function of atmospheric temperature and humidity, the author derives a formula for calculating the zenith distance variation of the effective radiation: $\frac{r(z)}{r(0)} = \cos^{L}z - 1/2(\cos^{L}z - 1)^2 - 0.018\ L\gamma_m(1-\cos z)$; L = values between 0.2 and 0.5 corresponding to $r(0) = 50\%$ and 20% respectively. Corrections for larger zenith distance (z) are given. Comparisons between observed data and computed value give a good agreement, at least for $z \leqslant 60°$. The author has shown that "there exists an almost constant zenith distance which is representative in the sense that parallel radiation in that direction equals the integrated hemispherical radiation." *Subject Headings:* **1. Terrestrial radiation 2. Radiation calculations.**—*L.D.*

4.1–124 551.521.3:551.521.61

Cleveland, E. Lynn and Raymond, Richard C. (*Pa. State College*), **Scattering of visible and near infrared radiation by layered distributions of small metal spheres.** *Optical Society of America, Journal*, 42(3):183–186, March **1952.** 4 figs., table, 13 refs., 5 equations. **DLC**—The effective scattering cross sections for metal spheres have been measured through the resonance region, using wavelengths between 0.45 and 15 microns. Spheres of iron and copper sorted into reasonably narrow diameter distributions between 2 and 20 microns were supported in layers on Pliofilm and silver chloride. The results are given in terms of the scattering area coefficient k (the ratio of scattering cross section to projected area of the spheres) as a function of α (the ratio of sphere circumference to the wavelength used). These results are in general accord with qualitative predictions based on the Mie theory. Detail in the resonance region is obscured by the finite diameter distributions of the samples. *Subject Headings:* **1. Scattering coefficient 2. Infrared radiation 3. Scattering of radiation.**—*Authors' abstract.*

4.1–125 551.521.3:551.508.21/5(09)(438)

*Gorczyński, Władysław, **O insolacji Gdańska, Sopotu i Gdyni w porównaniu z Warszawa.** [Intensity and totals of solar radiation of Gdańsk, Sopot and Gdynia in comparison with Warsaw.] *Towarzystwo Naukowe, Toruń, Sec. A (Math.-Phy.)*, 2(4), **1951.** 28 p. 5 figs., tables, 12 refs. English summary p. 26–28. **DWB**—The history and instrumental development of solarimetry in Warsaw since 1900 is summed up. Data of solar and diffuse radiation obtained at observatories in the former Free State of Danzig (Gdańsk) are reproduced in tables and graphs in various arrangements as presented by G. FRISCHMUTH for the period 1931–1934. Mean values for Gdańsk (Danzig) and Gdynia are compared with corresponding data for Warsaw. *Subject Headings:* **1. Solar radiation measurements 2. Radiation instruments 3. History of meteorology 4. Poland.**—*G.T.*

4.1–126 551.521.3:551.574.1

Gumprecht, R. O., Sung, Neno-lun, Chin, Jin H. and Sliepcevich, C. M. (*Univ. of Michigan*), **Angular distribution of intensity of light scattered by large droplets of water.** *Optical Society of America, Journal*, 42(4):226-231, April **1952.** fig., 9 tables. **DWB**—The angular distribution of intensity of light scattered by spherical particles whose index of refraction with respect to surrounding medium is 1.33 has been computed for values of α (circumference of the particle divided by the wavelength of the incident beam) equal to 6.0, 8.0, 10, 15, 20, 25, 30, 35, and 40. The results are presented in tabular form and give the intensities of the two incoherent, plane-polarized components of the scattered light as well as the real and imaginary parts of the complex functions from which the intensities are computed for angles of observation in the range 0° (10°) 170° (1°) 180°. A sample light-scattering diagram for $\alpha = 40$ is included. The tabulated values were calculated and checked by high speed computers; they extend considerably the range of values previously published. *Subject Headings:* **1. Scattering of light 2. Water droplet scattering 3. Scattering coefficient.**—*Authors' abstract.*

4.1–127 551.521.3:535.33

Plass, Gilbert N. and Warner, Douglas, **Line absorption from asymmetrical spectral lines.** Johns Hopkins University. Dept. of Physics, Contract Nonr-248(06), [Report] Jan. **1952.** 4+p. 2 figs., 6 refs., 4 equations. **DWB**—Graphs show curves for 1) absorption of a single line as a function of $M(S_a U)^{\frac{1}{2}}$, with the Lorentz and asymmetrical shapes, respectively and 2) transmission of an idealized band as a function of $S_a U/\pi d^2$, where d is the separation between line centers in the band. Work is basic for study of atmospheric heat transfer from either lines or bands. *Subject Headings:* **1. Line absorption 2. Spectroscopy. I. Johns Hopkins University. Dept. of Physics II. Contract Nonr-248(06).**—*M.R.*

4.1–128 551.521.3:551.508.21(675)

Schüepp, Walter, **Enregistrement séparé des composantes du rayonnement solaire.** [Registration of separate components of solar radiation.] *Belgian Congo. Service Météorologique, Bulletin*, 1(5):1–8, May **1951.** In French; French, German, English and Dutch summaries p. 1–2. **DWB**—Methods of measuring the direct and diffuse (sky) components of the solar radiation received on a horizontal surface are discussed and a graph and table presented to show quantitative relationships for Leopoldville, Belgian Congo, for the rainy season (Feb.–April) 1951. Necessary corrections are examined and applied. The diffuse radiation is measured by means of a disc placed over the pyrheliometer to shield it from the direct rays of the sun. A perfect solution of the problem is not possible, but the method used shows quantitatively the relation between direct and diffuse radiation at different times of the day, and the sum of the two as measured in this manner. *Subject Headings:* **1. Solar radiation measurement techniques 2. Diffuse radiation 3. Pyrheliometer corrections 4. Leopoldville, Belgian Congo.**—*M.R.*

4.1–129 551.521.3:551.510.42

Vittozzi, Pio, **Determinazione dell'energia diffusa da parte di un granulo di polvere vulcanica.** [Determination of the energy diffused by means of a particle of volcanic dust.] *Geofisica Pura e Applicata*, 22(1/2):89-96, Jan./March **1952.** 2 figs., 2 tables, 2 graphs, 9 refs., 28 eqs. Italian and English summaries p. 89. **MH-BH**—The author uses a graphical method of analysis to determine energy diffused by a small sphere of a given radius and given material when struck by a parallel beam of light. A similar case is analyzed (particle of volcanic ash) with the conclusion that diffused energy for a small sphere is 103% of incident energy, for volcanic ash it is 156%. *Subject Headings:* **1. Energy diffusion 2. Scattering of light 3. Volcanic dust.**—*M.R.*

4.1–130 551.521.4:551.521.3

Hulburt, E. O. (*Navy Research Lab., Washington, D. C.*), **Measurements of the brightness of the night sky.** (In: International Conference on the Emission Spectra of the Night Sky and Aurorae, London, 1947, Papers, **1948.** p. 76-82. 4 figs., 8 refs., 4 equations.) **DWB**—On the National Geographic Society and U. S. Air Forces eclipse expedition to Brazil in April and May 1947, measurements were made of daylight atmospheric attenuation at different solar

titudes, and of night sky brightness (with a Macbeth illuminator and a low brightness photometer). Data obtained are shown graphically. Solar radiation attenuation curves indicate an average ozone thickness of .32 cm, and a value of $\beta = 0.023$. Lunar illumination, zenith sky brightness and evening sky brightness data also shown graphically. Heights of luminescent layer or layers may have been from 50 to several hundred km. *Subject Headings:* **1. Atmospheric attenuation 2. Night sky brightness measurement 3. Luminescent layer heights.**—*I.R.*

4.1–131 551.521.4

Kvifte, Gotfred Ingolf, **Natthimmellyset.** [The light of the night sky.] *Naturen*, Bergen, 76(2):49–58, **1952. DWB**—The line spectrograph is described. Only $\frac{1}{4}$ of the light of the night sky is due to light from stars. The origin of the light is ascribed to "ignition" of the atoms by some external energy—possibly solar radiation, possibly cosmic radiation. The green as well as the red line in aurora borealis is explained by the peculiar capacity of the atoms to resume their fundamental state after the "ignition." This condition is known as "forbidden" radiation. A. B. MEINEL's recent observation of a band system in the infrared is assumed due to oxygen-hydrogen and its mean temperature to be somewhat below 0°C. The remainder of the radiation is of molecular origin. *Subject Headings:* **1. Light of the night sky 2. Scintillation 3. Radiation.**—*W. N.*

TEMPERATURE

See also: Large-scale aspects of energy transformation over oceans (Jacobs), 4.1–5; Weather in Belgrade, June 1949–Feb. 1951, 4.1–45; Severe winters in Europe (Sinz), 4.1–67; Diabatic flow of compressible fluid (Fleisher), 4.1–93; Synoptic research of winter weather of Japan (Ooi), 4.1–115

4.1–132 551.524.36:551.583.13(794)(55)

Court, Arnold (*Dept. of Army, Wash., D. C.*), **Duration of very hot temperatures.** *American Meteorological Society, Bulletin*, 33(4):140–149, April **1952.** 5 figs., 3 tables. **MH-BH**—The hourly duration of maximum temperatures at Death Valley, Calif., and Andimishk, Iran were investigated using temperature data of two summer months. The hourly duration of any daily maximum temperature is defined as the number of hourly observations on which the temperature (recorded to the nearest whole degree) was the same as the maximum; the hourly temperatures are expressed as deviations from the daily maximum and the frequencies of these deviations are analyzed statistically using only the difference between hourly temperatures and daily maxima on days when the maximum attained 110°F and higher. "The maximum temperatures on the hottest days in the hottest deserts occur generally around 3 hours after local noon and last about 2 hours with temperatures during one-fourth of the day (6 hours) varying within 4°F of the maximum temperature" and in time of duration and time of occurrence they resemble the maxima on cooler days. *Subject Headings:* **1. Extreme temperatures Persistence 3. California 4. Iran.**—*I.L.D.*

4.1–133 551.524.37:551.583.15(4)

Hagelen, W. J. H., **Een babbeltje over strenge winters.** [Some remarks on cold winters.] *Hemel en Dampkring*, 50(2):24, **1952. MH-BH**—In this informal discussion (based on articles published in *Hemel en Dampkring*) of the evidence for the increase or decrease of severe winters during the past 200 years, the author fails to find a confirmation of the 4×22-year cold and warm periods reported by C. EASTON ("Les hivers dans l'Europe occidentale"). A comparison of the period 1801–1850 with the period after 1900 indicates a rise in winter temperatures in the latter period and the 19th century had 12 severe winters of which ten occurred in the first half and two in the last half. Yet the severe winters during 1939–1950 lead to the conclusion that more data are needed before a definite statement can be made regarding the increase or decrease of the number of severe winters in western Europe. *Subject Headings:* **1. Severe winters 2. Climatic changes 3. Winter temperatures 4. Western Europe.**—*I.L.D.*

4.1–134 551.524.37:551.578.43

Ludlam, David M., **The mild and snowy winter of 1951–52.** *Weatherwise*, 5(2):41–44, April **1952. MH-BH**—During the winter of 1951–52 temperatures exceeded normal in the eastern two-thirds of the country and fell below seasonal normal in the plateau regions. The synoptic conditions associated with the lowest temperatures for the year in Colorado and Wyoming, the extent of storminess in the U. S., the intensity of the Sierra snows and of the Los Angeles flood with the associated synoptic conditions and the synoptic conditions associated with the February snows in New England are discussed with the aid of synoptic charts. *Subject Headings:* **1. Winter temperatures 2. Severe winters 3. Snowfall extremes 4. United States.**—*I.L.D.*

4.1–135 551.524.37:551.578.45(492)

Pelleboer, J. H., **Een jubileum; de strenge sneeuwwinter 1941–42.** [An anniversary: the severe winter of 1941–42.] *Hemel en Dampkring*, 50(3):54, **1952. DLC**—The winter of 1941–42 was perhaps the coldest experienced in the Netherlands during the past two and a half centuries. A temperature of −27.4°C was recorded at Winterwijk, the lowest ever measured in Holland. Some extreme data on temperatures on other dates, on wind velocities and on snow depths are given. Photographs illustrating snowfall are reproduced. *Subject Headings:* **1. Severe winters 2. Minimum temperatures 3. Snowstorms 4. Netherlands.**—*I.L.D.*

4.1–136 551.524.37(492)

van der Ham, C. J., **De recordkoude van 29 en 30 Mart 1952.** [The record cold spell of March 29 and 30, 1952.] *Hemel en Dampkring*, 50(4):76–77, **1952. MH-BH**—A description of the synoptic conditions over the European continent, in particular the distribution of air pressure which gave rise to the record cold of March 29 and 30, 1952 in Holland, and the synoptic situation in Holland. The maximum temperatures at De Bilt were 0.1° and 0.4°C on the two days. *Subject Headings:* **1. Cold waves 2. Synoptic studies 3. Netherlands.**—*I.L.D.*

4.1–137 551.524.7

Holzapfel, Rupert, **Grossräumige Störungen im normalen Jahresverlauf oberhalb der Tropopause.** [Large scale disturbances in the normal annual variation above the tropopause.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:113–116, **1952.** 2 figs. 8 refs. **MH-BH**—Monthly means of temperature at 200 and 225 mb over Erlangen 1947–51 show differences from normal unrelated to those at lower levels. These disturbances indicate that circulations above and below the tropopause are independent. *Subject Headings:* **1. Upper air temperatures 2. Tropopause 3. Erlangen, Germany.**—*C.E.P.B.*

4.1–138 551.524.7:523.32:551.52

Wegener, Kurt, **Die Temperatur der Mondoberfläche.** [Temperature of the moon's surface.] *Zeitschrift für Meteorologie*, 6(5):147–148, May **1952.** fig. **DWB**—A comparison is made between the heat exchange of the earth and space and of the moon and space. It is concluded that the diurnal temperature at the surface of the moon is sinusoidal and the minimum temperature is attained a few minutes after sunset and that the temperature exchange between the moon and space is solely radiational so that the night temperature at the surface of the moon is determined by the radiation balance between the surface of the moon and space. On p. 148 ("Zur Frage der Oberflächentemperatur des Mondes," 2 refs.) FRITZ MÖLLER criticizes the assumption of a radiational equilibrium in the stratosphere since available data on absorption spectra indicate that such a simple equilibrium does not exist. Moreover, the fact that the temperature of the moon at night is above absolute zero indicates that there is heat exchange by conduction also and not by radiation alone. *Subject Headings:* **1. Lunar temperatures 2. Temperature of the stratosphere 3. Radiation balance in space. I. Möller Fritz.**—*I.L.D.*

SOIL TEMPERATURE

4.1–139 551.525.4

Sato, S. (*Kyushu Ag. Exp. Sta., Japan*), **On the thermal diffusibility in the soil of cultivated eld.** *Journal of Agricultural Meteorology*, Tokyo, 6(3/4):182–184, Aug. **1951.** fig., 2 tables, 1 eqs. In Japanese, English summary p. 184. **DWB**—The thermal diffusivity ($a^2 = k/c_p$) the soil is calculated from the index (p) of soil temperature, and concluded that formula

$$a^2 = \frac{fk_1x + k_2y + k_3z}{(c_1x + c_2y + c_3z)(\rho_1x + \rho_2y + \rho_3z)}$$

suitable for cultivated fields. *Subject Headings:* **1. Thermal diffusivity 2. Soil temperatures.** *–M.R.*

4.1–140 551.525.4

Timofeev, M. P., **Opredelenie temperaturoprovodnosti pochvy priborom Chudnovskogo.** [Determination of thermal conductivity in soil by means of Chudnovskii's instrument.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 39, Fizika Prizemnogo Sloia Atmosfery, p. 37–43, **1947.** 4 tables, eqs. **DLC**—The observations were carried out by the expedition of the Central Geophysical Observatory in Arys' in 1945. A. F. CHUDNOVSKIĬ proposed the following method for determining the coefficient of thermal conductivity: an iron case is sunk into the oil and filled with hot water and the speed of heat convection proceeding from this source is observed for determination of the coefficient. The results were compared with analogous determinations made in the same place by VOLOSHINOVA, and showed a definite possibility of the application of CHUDNOVSKIĬ's method. *Subject Headings:* **1. Soil temperatures 2. Thermal conductivity 3. Soil conductivity. I. Chudnovskiĭ, A. F.**— *N.T.Z.*

4.1–141 551.525.4

Voloshinova, G. A., **Teploobmen v pochve.** [Heat exchange in the soil.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby. Trudy Naucho-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 39, Fizika Prizemnogo Sloia Atmosfery, p. 32–36, **1947.** fig., eqs. **DLC**—The observations were carried out during Aug.–Sept. 1945 in Arys'. Soil temperature was observed under bare surface and under surface scantily covered with dry grass. The thermometers of SAVINOV and electrical thermometers were installed to a depth of 120 cm. The observations proved that at night (8 p.m.–4 a.m.) the heat flow is practically constant. The direction of the flow changed at 6 a.m. and 4 p.m. The greatest intensity of heat flow from the soil to the atmosphere was noticed around 6–8 p.m.; the greatest intensity of heat flow from the air into the soil was observed near 10–12 a.m. With a great amount of cloudiness (Aug. 3–31) the change of flow came one hour later. *Subject Headings:* **1. Heat exchange 2. Soil temperatures 3. Soil-air heat exchange 4. Soil thermometers 5. Turkestan, U.S.S.R.**— *N.T.Z.*

4.1–142 551.525.5:016

†Black, Robert F. (*U. S. Geological Survey*), **Permafrost.** *Smithsonian Institution, Annual Report*, 1950:273–301, **1951.** 3 figs., 12 plates, refs. **DWB**—"This paper is largely a compilation of or reference to recent available literature." It gives a comprehensive summary of the physical properties of frozen ground—its geologic, engineering and biologic aspects, its dependence on climatic factors and the solution of practical problems connected with it (water supply, sewage disposal, agriculture, mining, refrigeration and storage, trafficability, military operations). Typical features of permafrost are presented in photographs, its areal distribution shown on a chart and two diagrammatic cross sections taken along long. 120° and 150°. Temperature profile curves for areas of continuous, discontinuous and sporadic permafrost are given. Most of the information was taken from Russian publications. One hundred and sixteen references to books, bibliographies, reports, articles and unpublished papers, mostly in English and German, are added. *Subject Headings:* **1. Permafrost 2. Bibliographies.**—*G.T.*

4.1–143 551.525.5

Umetani, H. (*Central Met. Observ., Tokyo*), **On the freezing phenomena of soil.** *Journal of Agricultural Meteorology*, Tokyo, 6(3/4):173–175, Aug. **1951.** 3 figs., 4 tables. In Japanese, English summary p. 175. **DWB**—Various forms of frozen soil are due to varying soil moisture, providing soil density and cooling rate (soil-air) are constant. Classes of frozen soil were as follows: frost columns (>50% water), concrete-like (>40% water), stratified ice crystals and soil grains (33–40%), no ice crystals (<33%). Isopleth charts show changes with depth in soil moisture content on several days. *Subject Headings:* **1. Soil freezing 2. Frozen soil types 3. Soil moisture.**—*M.R.*

PRESSURE AND WIND

PRESSURE

See also: Diabatic flow of compressible fluid (Fleisher), **4.1–93**

4.1–144 551.542:551.501.42(497.1)

Makjanić, B. (*Zagreb*), **O redukciji mjesečnog sredjaka tlaka zraka na morsku razinu.** [On the reduction of monthly mean values of the barometric pressure to mean sea level.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorološki Glasnik*, 3:26–48, **1950.** 7 tables, 12 refs., eqs. In Croatian, English summary p. 48–49. **DWB**—For the reduction of air pressure to MSL in the meteorological routine the equation $p_0 = p_e \frac{gz}{RT'm}$ is offered, where p_0 = pressure MSL, p = pressure for height z above sea level, g = acceleration of gravity, R = gas constant and $T'm$ arithmetic mean value of temperature of a column of air between MSL and height z. In climatological work the pressure can be reduced either by applying a monthly mean value of air temperature to the monthly mean value of pressure, or by making the reduction for every observed value of pressure by means of simultaneous observed temperature and then computing the monthly mean value. Equations and working tables for both methods are presented and results compared. *Subject Headings:* **1. Pressure reduction 2. Reduction tables 3. Yugoslavia.**—*G.T.*

4.1–145 551.543:551.590.21:550.384

Craig, Richard A. and Hawkins, David, **Atmospheric pressure changes and solar activity.** Harvard University, Contract W19-122ac-17, Special Report, No. 38, March 17, **1951.** 34 p., 5 figs., 14 tables, 2 refs., 8 eqs. **DWB**—Extension and statistical evaluation of work of Duell and Duell on correlation of geomagnetic activity, solar flares and surface pressure changes over Northern Hemisphere between 30° and 70°N. Authors claim that following significant solar flares, the pressure variation for two to four days is greater than might be expected by chance (rises occur near low pressure centers and falls near high pressure centers). For brief summary *see item* 3.3–150, March 1952, *MAB*. *Subject Headings:* **1. Solar influences 2. Atmospheric pressure. I. Harvard University II. Contract W19-122ac-17.**—*M.R.*

4.1–146 551.543.3

Nagao, T., **Ten-day period of air pressure in Kanto District.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(2):65–70, Feb. **1952.** 5 figs., eqs. In Japanese, English summary p. 65. **MH-BH**—Data on pressure variations, on their regional distribution and on their correlation with temperature departures are presented in tables, graphs and charts. It is found that a significant periodicity in pressure variation can be established, especially around the middle of July and during the last decade of September. The author considers this periodicity to be "a stationary oscillation" which is closely connected with changes in temperature. *Subject Headings:* **1. Pressure periodicities 2. Pressure-temperature correlations 3. Kanto District, Japan.**—*G.T.*

WIND

See also: Wind stress over trade region (Sheppard and Omar), 4.1–10; Westerlies over sea (Sheppard and others), 4.1–11; Prevailing winds, Pavia (Aliverti and Avico), 4.1–42; Error of cup anemometers in fluctuating winds (Deacon), 4.1–47; Monsoon forecasting for Java (Ressinck), 4.1–65; Tornadoes, Potsdam, June 26, 1951 (Klauser), 4.1–108; Spring tornadoes, tornado warning service, 4.1–109; Carolina Bays and pleistocene weather map (Odum), 4.1–223; Local climatology, Japan (Sekiguti), 4.1–226; Bibliography on theory of turbulence, 4A–1 to 4A–205

4.1–147 551.55:551.501.3

Roll, Hans Ulrich, **Zur Frage der Umrechnung Beaufort-Knoten auf See.** [On the question of converting Beaufort to knots at sea.] *Annalen der Meteorologie*, 4(7/9):408–410, **1951.** 2 figs., 2 refs. **DWB**—Estimation of wind speed from state of sea is uncertain. One reason is that speed profile between sea surface and masthead varies, so that with same estimated force, speed at 20–30 m increases with increasing temperature difference air–sea. With no temperature difference the relation between Beaufort force and measured speed is linear. *Subject Headings:* **1. Beaufort scale 2. Wind estimation.**—*C.E.P.B.*

4.1–148 551.55:551.501.4

Roll, Hans Ulrich, **Zur Reduktion der Windgeschwindigkeitsmessungen an Bord auf 10 m. Höhe (Vorläufige Mitteilung.)** [On the reduction of wind speed measurements on board ship to 10 m. height (preliminary report).] *Annalen der Meteorologie*, 4(7/9):410–411, **1951.** fig., table. **DWB**—Wind profiles off Neuwerk Island near Hamburg were obtained on a beacon, at about ½, 1, 5, 10 and 23 m above sea and expressed as percentages of speed at 10 m. They were all in air 2–3°C colder than water. *Subject Headings:* **1. Wind profiles 2. Neuwerk Island, North Sea.**—*C.E.P.B.*

4.1–149 551.553.1:551.553.6:551.506.3(691)

*Ravet, Jacques, **Statistiques du vent au sol à Madagascar aux Comores et à la Réunion.** [Statistics on surface winds at Madagascar, Comoro Islands and Reunion Islands.] *Madagascar. Service Météorologique, Publication*, No. 17, Aug. **1949.** 80 p. chiefly charts and tables. **DWB**—Observational data from 22 stations indicating ground wind frequencies, directions, speeds and their daily variations are presented in this paper for the period 1938–1947. Three individual observations are represented in a graph and two anemocinemographs. *Subject Headings:* **1. Wind variations 2. Wind frequencies 3. Madagascar 4. Comoro Islands 5. Reunion Island.**—*G.T.*

4.1–150 551.553.21:551.506.3(492)

*Visser, S. W., **De Europese moesson in Nederland.** [The European monsoon in the Netherlands.] *Hemel and Dampkring*, 50(4):61–66, **1952.** 3 figs., 2 refs. **MH-BH**—The general characteristics and causes of the west European monsoon are discussed briefly and a detailed description of its manifestation in the Netherlands as northerly winds in the summer and southerly winds in the winter is given. Figures showing the mean decadal temperatures (1911–1950) at Den Helder during the period in which the monsoon influence prevails, and wind roses for five Netherlands stations for May and Nov. and for every month at Den Helder, and tables giving the differences of the products of wind frequency in percent by wind speed (Beaufort scale) are presented. *Subject Headings:* **1. Monsoons 2. Monsoon winds 3. Temperature variations 4. Wind frequencies 5. Long period records 6. Netherlands.**—*I.L.D.*

4.1–151 551.555.3(788)

Cook, A. W. and Topil, A. G., **Some examples of chinooks east of the mountains in Colorado.** *American Meteorological Society, Bulletin*, 33(2):42–47, Feb. **1952.** 7 figs., 18 refs. **MH-BH**—A study of chinook winds in eastern Colorado based upon upper air observations obtained by means of raobs and upon potential and equivalent potential temperatures over the Rockies indicates that the rise in temperature during a chinook is a consequence of advection of warmer air or the replacement of a cold air mass by a warm air mass, subsidence and the prevention or destruction of the normal nocturnal ground inversion; and that precipitation on the windward side of the Colorado mountains is not necessary for the formation of a chinook.

Six examples of chinook winds were studied and a detailed description of one giving surface map and 1000 ft map is presented. *Subject Headings:* **1. Chinook theory 2. Colorado.**—*I.L.D.*

4.1–152 551.556:551.465(26)

*Polli, Silvio (*Instituto Talassografico, Trieste*), **Moto ondoso e vento nel Golfo di Trieste.** [Wave motion and wind in the Gulf of Trieste.] *Geofisica Pura e Applicata*, 21:102–109, **1952.** fig., 5 tables, refs. Italian and English summaries p. 102. **MH-BH**—Monthly and annual mean values of wave motion are derived from 1931–1950 data. Correlation coefficients found between wind velocity and wave motion varied from +0.49 to 0.94. *Subject Headings:* **1. Wind waves 2. Ocean wave measurements 3. Gulf of Trieste.**—*M.P.K.*

4.1–153 551.556:551.465

Roll, Hans-Ulrich (*Met. Amt für NW-Deutschland, Hamburg*), **Gibt es eine "kritische Windgeschwindigkeit" für Prozesse an der Grenzfläche Wasser-Luft?** [Is there a "critical wind velocity" for air-sea boundary processes?] *Geofisica Pura e Applicata*, 21:110–126, **1952.** 11 figs., 21 refs. German and English summaries p. 110. **MH-BH**—Although it seems there is no absolute "critical wind velocity," observations indicate that there are relative values dependent on fetch. The following observed marks support the theory of relative values: change from smooth to rough sea, change from laminar to turbulent boundary-layer flow, breaking of gravity waves and decrease of the resistance coefficient of the sea surface to a minimum. *Subject Headings:* **1. Wind waves 2. Ocean-atmosphere stress 3. Wave forms.**—*M.P.K.*

4.1–154 551.556.2:63

Thran, P., **Ertragssteigerungen durch den Windschutz der Wallhecken (Knicks) in Schleswig-Holstein.** [Increase in yields through the wind protection afforded by hedges in Schleswig-Holstein.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 32: 57–59, **1952.** 4 figs., table. **DWB**—It is shown that the wind protection afforded by hedges significantly increases the yield by as much as 50 to 100%. *Subject Headings:* **1. Agricultural meteorology 2. Windbreaks 3. Crop yield 4. Schleswig-Holstein, Germany.**—*A.A.*

4.1–155 551.557.3:551.501.8

*Edwards, H. N. (*Chippendale, N.S.W. Australia. Commonwealth Scient. & Indust. Res. Organization*), **Some measurements of velocity of high altitude winds at Sydney, NSW.** *American Meteorological Society, Bulletin*, 33(2):56–59, Feb. **1952.** 2 figs., 3 tables, 6 refs. **MH-BH**—A method which involves the use of a balloon assembly, consisting of a small, silver-coated balloon, acting as a radar reflector, within a large meteorological balloon and an air-warning radar set operating on a wave length of 25 cm with a maximum power of 500 kw and a pulse duration of 4 microseconds, for measuring horizontal wind velocities at high altitudes, is described. Wind velocity measurements made at Sydney during March–Aug. 1949 indicate a maximum speed at 40,000 ft of about 70 mph from a westerly direction and a minimum speed of about 5 mph at 70,000 ft, which had a westerly direction during April–June and an easterly direction during July–Aug. Tables showing mean monthly maximum wind speeds and individual cases of minimum wind speeds are given. *Subject Headings:* **1. Upper air winds 2. Radarsondes 3. Sydney, Australia.**—*I.L.D.*

4.1–156 551.557.3:551.510.535:551.508.59

Millman, George H. (*Ionosphere Res. Lab. Pennsylvania State Col.*), **A note on ionospheric wind measurements at 150 Kc/s.** *Annales de Géophysique*, Paris, 7(4):272–274, **1951.** 3 figs., 6 refs. **MH-BH**—The method used in ionospheric wind measurements, currently conducted at the Ionosphere Research Laboratory, Pennsylvania State College, is briefly described. The magnitude and direction of wind is calculated from the amplitude of hop-echoes reflected from the lower edge of the E layer, as recorded by 3 receivers placed at the corners of a right triangle. The high-power impulse transmitter operates at about 5 km from the receivers at a frequency of 150 Kc/sec. Data on ionospheric wind directions and magnitudes for July and Aug. 1951

are presented and commented on. *Subject Headings:* **1. Ionospheric winds 2. Wind observation 3. E layer. I. Pennsylvania State College. Ionosphere Research Laboratory.**—*G.T.*

4.1–157 551.558 551.508.5

Konstantinov, A. R., **Vertikal'nye skorosti vetra v atmosfere i metody ikh izmereniĭ.** [Vertical wind velocity in the atmosphere and methods of measurement.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, 1:91–97, 1951. 4 figs., 10 refs. **DLC**—A short review of methods and instruments used for measurement of vertical wind velocity. These methods can be classified into two classes: 1) the use of pilot balloons, kites, aeroplanes, gliders and smoke generators, and 2) the use of special mechanical manometrical, electrical instruments. The latter give more accurate results. During 1947–1948 the author constructed in the Central Geophysical Observatory three different types of apparatus for measuring vertical wind velocity. The first type is a modification of the usual anemometer; the second instrument is a modification of Wild's wind vane. The third model, the so-called hot wire anemometer, is based on the principle of definite loss of heat by the wire placed in an air flow. The temperature of the wire is measured by a thermocouple. *Subject Headings:* **1. Vertical wind velocity measurement 2. Anemometers 3. Turbulence measurement.**—*N.T.Z.*

4.1–158 551.558.29

Malsch, W. (*Karlsruhe*), **Luftlawinen aus der freien Atmosphäre.** [Air avalanches from the free atmosphere.] *Meteorologische Rundschau*, 5(1–2):20–21, Jan.–Feb. 1952. fig. **MH-BH**—Several cases are described when at night calm or light laminar flow at Karlsruhe was interrupted for an hour or two by a squally wind associated with a marked rise of temperature and fall of humidity. Attributed to a break of the "free föhn" through the surface inversion. *Subject Headings:* **1. Free föhn 2. Karlsruhe, Germany.**—*C.E.P.B.*

AQUEOUS VAPOR AND HYDROMETEORS

HUMIDITY AND EVAPORATION

See also: Snow and its relationship to experimental meteorology (Shaefer), 4.1–7; Improved dew point hygrometer for high altitude (Storey), 4.1–56; Comparative evaporation observations (Leistner), 4.1–59; Flight camera for photographing cloud droplets . . . (McCullough and Perkins), 4.1–60; AgI as cloud seeding agent (Neumann), 4.1–72; Angular distribution of intensity of light scattered by large water droplets (Gumprecht, et al.), 4.1–126; Evaporation of drops in an air current (Shvets), 4.1–194; Infiltration, evaporation and transpiration (Grinsted), 4.1–198; Humidity distribution and surface cover (Sekiguti), 4.1–227.

4.1–159 551.571.7(42)

*†Bannon, J. K., Frith, R. and Shellard, H. C., **Humidity of the upper troposphere and the lower stratosphere over southern England.** *Great Britain. Meteorological Office, Geophysical Memoirs*, 11(88), **1952.** 36 p. 19 figs., 14 tables, 13 refs. **DWB**—Observations of air temperature and frost point on 130 flights from Boscombe Down 1943–46 and South Farnborough 1949–50 are summarized for pressure levels 500–187 mb and at tropopause, by seasons Jan.–March, April–June etc., separately for different tropopause levels. Air mass and circulation types are also given. The variation of relative humidity over ice is tabulated from 50 mb below to 100 mb above tropopause, and also as a function of temperature and frost point. Mean half-yearly curves of frost point and temperature are shown for ascents grouped in various ways according to tropopause type or height. Relations between frost point and tropopause pressure, 500 mb temperature, circulation type, air mass and frontal surfaces are set out and 21 observations near jet stream discussed. *Subject Headings:* **1. Upper air humidity 2. Upper air temperatures 3. Frost point 4. British Isles.**—*C.E.P.B.*

4.1–160 551.571.7:551.521.1

Brewer, Alan W., **The measurement of the water vapour content of the atmosphere by dew- or frost-point measurement.** *International Union of Geodesy and Geophysics. Associa-*

tion of Meteorology, Oslo 1948, Transactions, v. 2, **1950.** p. 56–58. Mimeographed. **DWB**—An equation for determining the water vapor height profile in the lower stratosphere is derived on the assumption of continuous and smooth movement of air from the tropopause to the stratosphere and downward from stratosphere to troposphere. It is shown that the smoothness of the ordinary temperature-height curve is not due to small scale turbulence but most probably to radiation. *Subject Headings:* **1. Water vapor measurements 2. Humidity lapse rate 3. Radiation effects.**—*I.L.D.*

4.1–161 551.573:631.4

Burov, D. I., **Isparenie vody paruiushcheĭ pochvoĭ i pochvoĭ pod rastitel'nym pokrovom v usloviiakh Zavolzhia.** [Evaporation of water from fallow and from soil under plant cover in the Trans-Volga.] *Pochvovedenie*, Leningrad, No. 1:41–52, **1952.** 2 figs., 6 tables, 27 refs. **DLC**—A description of various experiments on the influence of plants and of the soil structure on evaporation from the soil are given. Evaporation increases significantly with coarse soil structure (free air circulation) and also with fine soil structure (capillary movement of water). For bare soil the influence of the soil structure is characterized by the following numbers:

Dimensions of the soil particles (mm)	.5	.5–3	3–10	10–50
Evaporation as percentage of optimum	150	100	140	240

Plants decrease the evaporation from the soil 1.5–2 times and also reduce the influence of the soil structure. *Subject Headings:* **1. Vegetative influences 2. Evaporation from soil 3. Trans-Volga.**—*A.A.*

4.1–162 551.573

Halstead, Maurice H., **Theoretical derivation of an equation for potential evapotranspiration.** Johns Hopkins University. Laboratory of Climatology, Seabrook, N. J., *Micrometeorology at the surface layer of the atmosphere. Interim Report*, 16:10–12, Dec. 31, **1951.** 9 eqs., 2 refs. **DWB**—The author assumes a linear dependence of the coefficient of diffusion on height. At the surface itself the diffusion of water vapor is molecular; at higher levels it is turbulent. After a few approximations the author derives the formula $E = C_1 L(\rho_1' - \rho_0')$. E = total evaporation; C_1 = constant; L = length of day; ρ_1 = density of water vapor in the air; ρ_0 = density of water vapor at the evaporating surface. Assuming that the temperature of the evaporating surface is equal to the air temperature, that the density of water vapor has no diurnal course, that the air is saturated during the nocturnal temperature minimum and that the total evaporation during the day is proportional to the evaporation during the maximum temperature, the author proposes the simple formula $E = C_2 L(\rho'_{T\max} - \rho'_{T\min})$ for maximum density of saturated water vapor at maximum and minimum temperatures. It is suggested that this formula be used for the computation of the total potential evapotranspiration. *Subject Headings:* **1. Evaporation 2. Evapotranspiration 3. Turbulent diffusion. I. Johns Hopkins University. Laboratory of Climatology, Seabrook, N. J. II. Contract W28-099-ac-378.**—*A.A.*

4.1–163 551.573:551.508.7(438)

Schmuck, Adam, **W sprawie metod pomiarow parowania v Polsce.** [On the methods of measurement of evaporation in Poland.] *Wroclawskie Towarzystwo Naukowe, Sprawozdania*, v. 5, Suppl. 1, **1950.** 14 p. 5 figs., 10 tables, 7 refs. **DWB**—The need for uniform data is stressed and the network in Poland (a dozen or more stations) and the types of equipment and exposure are discussed. Observations and investigations made at Wroclaw (Breslau) University in 1949 and 1950 are outlined and the conclusion reached that the Wild evaporimeter should be used universally and installed at a standard height. Tables and graphs show comparative results of measurements made with the Wild and Piché evaporimeters in different conditions. *Subject Headings:* **1. Evaporation networks 2. Evaporimeters 3. Poland.**—*M.R.*

4.1–164 551.574:536.42

Hardy, J. K., Hales, K. C. and Mann, G., **The condensation of water on refrigerated surfaces.** *Great Britain. Department of Scientific and Industrial Research. Food Investigation Board, Special Report*, No. 54, **1951.** 34 p. 10 figs., 10 tables, 40 eqs., 11 refs.—The report

studies the rate at which water vapor from a stream of air will condense on a cold surface. Pt. I deals with theory, including rate of condensation, transfer of heat and insulating effect of frost. Pt. II describes experiments on the transfer of water vapor and heat between an air stream and a wetted plate. Pt. III describes experiments on heat transfer from an air stream to banks of pipes. *Subject Headings:* **1. Condensation 2. Heat transfer.**—*C.E.P.B.*

4.1–165 551.574.1

Coulter, Lowell Vernon; Kland-English, Mathilde June and Zdanuk, Edward, **The role of surface forces in water vapor adsorption on foreign nuclei. The adsorption of water vapor on silver iodide.** Boston University, Contract AF19(122)-361, Report No. 4, Dec. 3, 1951. 8 p. 2 figs., 4 refs. **DWB**—The 34° adsorption isotherm of water on silver iodide has been completed. The isotherm exhibits a sharp rise in adsorption at $P/P_0 \cong 0.5$ which is tentatively regarded as an indication of the coexistence of two phases in a localized monolayer. *Subject Headings:* **1. Adsorption of silver iodide 2. Adsorption of water vapor 3. Condensation nuclei. I. Boston University II. Contract AF19(122)-361.**—*Authors' abstract.*

4.1–166 551.574.1

La Mer, Victor K. and Gruen, Ruth (*Columbia Univ., Dept. Chemistry, N. Y.*), **A direct test of Kelvin's equation connecting vapour pressure and radius of curvature.** *The Faraday Society, Transactions*, 48(5):410–415, May 1952. 3 figs., 5 tables, 16 refs., 8 eqs. **DWB**—Although Kelvin's relation (1871) predicting the increase in vapour pressure with increasing curvature is basic to colloid science, e.g. phenomena of capillarity, production and stability of colloidal systems, etc., no unambiguous direct experimental confirmation has ever been obtained. Its acceptance has rested upon the thermodynamic cogency of the derivation and the success of theories based upon it. Our direct verification is based upon an extension of the growth method of measuring the radii of monodisperse aerosol droplets initially too small for accurate determination by light scattering methods. The test involves measuring the extent to which the Kelvin relation controls under equilibrium conditions the growth of monodisperse non-volatile aerosol droplets when exposed to the vapours of a master solution consisting of the nonvolatile component plus an excess of a volatile miscible solvent. Excellent quantitative confirmation has been obtained for the systems dioctyl phthalate+toluene and oleic acid+chloroform. *Subject Headings:* **1. Vapor pressure over drops 2. Kelvin's equation 3. Drop growth.**—*Authors' abstract.*

4.1–167 551.574.1

Weickmann, Helmut, **The problem of the formation of precipitation in cumulonimbus clouds.** (In: **Thunderstorm electricity.** Chicago University, Dept. of Meteorology, Oct. 1950. p. 51–95. 15 figs., 4 tables.) **DWB**—A theory that ice formation proceeds by the formation of ice crystals from supercooled water and that crystal structures are effective freezing nuclei is presented. The mechanism for the growth of ice crystals as water vapor condenses upon them is illustrated with the use of sheet mica and silver iodide crystals. The author also summarizes: investigation on frequency of natural freezing nuclei under laboratory and outdoor conditions, the relationship between ice crystal frequency and temperature and between temperature and crystallization, the shape and growth of ice crystals and the temperature interval 0° to −40°C., the shape of crystals in cumulonimbus clouds, the formation of hailstones and the formation of precipitation. Photographs of various types of ice crystals are included. *Subject Headings:* **1. Ice crystal formation 2. Freezing nuclei 3. Hail formation 4. Cumulonimbus clouds.**—*I.L.D.*

4.1–168 551.574.1

Yamaguchi, S., **On the effect of the radius and concentration of a drop of solution on the surface tension and saturated vapor pressure.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(11):384–388, Nov. 1951. 2 figs., 3 tables, 5 refs., 12 eqs. In Japanese, English summary p. 384. **MH-BH**—The theory of the effect of the radius and concentration of a drop of solution upon the surface tension is applied to a drop of NaCl solution. An outline is given of previous investigations published by different authors in English. The author emphasizes the fact that vapor pressure over a very small nucleus (about 10^{-16}g) with concentrated solution

of NaCl is very different from the commonly accepted value. *Subject Headings:* **1. Saline nuclei 2. Surface tension.**—*A.A.*

4.1–169 551.574.41(569.4)

Brooks, Charles F., **Current dew research in Israel.** *American Meteorological Society, Bulletin*, 33(2):55, Feb. **1952. MH-BH**—The dew gradients from a height of 1 meter down to the ground have been determined (a) for the summer dry season, (b) for the rainy season and (c) for the transition periods. A complete year of such measurements has been made, and also of condensation within the upper layers of the soil (on metal dew depositors). *Subject Headings:* **1. Dew investigations 2. Soil moisture measurement 3. Israel.**—*From author's abstract.*

CLOUDS

See also: Use of clouds in forecasting (Brooks, C. F.), 4.1–2

4.1–170 551.576:551.509.34(04)

§Cannegieter, Hendrik Gerrit, **Wat leeren ons de wolken? Het weer en zijn onturkkeling.** [What do we learn from clouds? The weather and its causes.] 2nd ed. Amsterdam, Albert de Lange, **1949.** 164 p. photos., diagrs., graphs, charts. **DWB**—A popular book dealing with basic facts and definitions of common technical terms and containing explanatory charts, curves and photos, for people interested in an elementary study of weather elements and their relationships. Attention is given to static and dynamic phenomena in the atmosphere, the vertical structure of the atmosphere, cloud formation, weather forecasting, etc. A series of 60 very good cloud photographs illustrative of indications of coming weather are appended. Many atmospheric sounding diagrams and synoptic charts give illustrations of situations which produce certain cloud formations. *Subject Headings:* **1. Cloud forecasting 2. Cloud photographs 3. Synoptic forecasting.**—*G.T.*

4.1–171 551.576.1

Donitch, N. (*Tamanrasset*), **Formation de nuages mammatus observée le 26 mars 1948 à Tamanrasset (Hoggar, Algérie Meridionale).** [Formation of mammatus clouds observed on March 26, 1948 at Tamanrasset (Hoggar, southern Algeria).] *Annales de Géophysique*, 7(2):136, April–June **1951. MH-BH**—During the past 15 years the author has many times observed virga from cumulonimbus clouds at Tamanrasset but this was the first instance of virga becoming distinct mammatus. The phenomenon is illustrated by four rather obscure photographs. *Subject Headings:* **1. Virga 2. Mammatus clouds 3. Tamanrasset, Algeria.**—*M.R.*

4.1–172 551.576.1:77

Hurst, G. W., **Cloud photographs taken from Comet aircraft.** *Meteorological Magazine*, London, 81(960):173–174, June **1952.** 8 photos. **DWB**—A notable series of photographs over S. Italy, India and Malaya from 34000–38000 ft. *Subject Heading:* **1. Cloud photographs.** —*C.E.P.B.*

4.1–173 551.576.11

Disselkamp, Theodor, **Wetterskizze Nr. 12—Über eine merkwürdige Wolkenerscheinung.** [On a remarkable cloud phenomenon.] *Annalen der Meteorologie*, 4(10–12):477–478, **1951.** 2 figs. **DWB**—At Iserlohn, Oct. 5, 1951, 3 hemispherical clouds 300 m long, 100 m deep appeared at a height of 700–800 m. In spite of strong winds they were stationary. Attributed to standing waves at a discontinuity. *Subject Headings:* **1. Cloud systems 2. Iserlohn, Germany.**—*C.E.P.B.*

4.1–174 551.576.12:001.4:484

Parczewski, Wladyslaw, **Podzial chmur.** [Cloud classification.] *Gazeta Obserwatora PIHM*, Warsaw, 3(8):4–9, Aug. **1950.** 10 figs., 2 tables. **DLC**—A classification of clouds according to their appearance, elevation, or method of formation is presented. The ten main types of clouds are described in text and tables and illustrated. The Latin and Polish names

of the clouds are given along with the symbols and abbreviations. *Subject Headings:* **1. Cloud classification 2. Terminology 3. Polish language.**—*A.M.P.*

4.1–175 551.576.2

*Čadež, M., **Oblačnost u Ljubljani u razdoblju Mart 1943–Mart 1947.** [Cloudiness at Ljubljana during the period March 1943–March 1947.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorološki Glasnik*, 1(1):27–31, Aug. **1948.** fig. In Croatian. **DWB**—Data on annual and monthly means of variation in cloudiness within the day and on seasonal variation in cloudiness are presented in graphical and tabular form. The data are based on two-hourly visual observations made by the author near Ljubljana. Synoptic properties of the region are described and the statistical material presented is discussed. *Subject Headings:* **1. Cloud data 2. Cloud observations 3. Ljubljana, Yugoslavia.**—*G.T.*

4.1–176 551.576.4

Very high cloud layer, August 10, 1951. *Meteorological Magazine*, London, 80(954):365–366, Dec. **1951. MH-BH**—Account of thin cloud over Lancashire, 46,500–47,500 ft. Temperature −56°C at 45,000 ft. Tropopause 37,000–40,000 ft. *Subject Headings:* **1. Cloud height measurements 2. Clouds in stratosphere 3. Lancashire, England.**—*C.E.P.B.*

PRECIPITATION

See also: Content of nitrogen in atmospheric precipitation (Ångström and Högberg), 4.1–1; Long range forecasts of rainfall (Rosenan), 4.1–66; Precipitation pattern associated with Atlantic coastal storm (Carr), 4.1–101; Aridity index, Madagascar (Duvergé), 4.1–229.

4.1–177 551.577.2:551.577.37(83)

*González Mella, Raúl, **Datos comparados de las precipitaciones medidas en las estaciones de Santiago y Macul, en el año 1950, y el promedio de 50 años (1901–1950) para Santiago.** [Comparative data of precipitation measured at the stations of Santiago and Macul, in 1950 and the average for 50 years (1901–1950) for Santiago.] *Chile. Universidad. Instituto de Geografía, Informaciones Geográficas*, 1(1):13–14, April **1951.** 2 tables, ref. **DWB**—Data of monthly total rainfall and of monthly rainfall intensity at Santiago and Macul in 1950 and 50-year monthly totals at Santiago are tabulated. The number of rainy days in 1950 was 34 for both stations and there was no difference in duration of the rainy season (April–Nov.). Prolongation of the rainy season with high values in Nov. and a rainless July (the first for 50 years) are indicated as outstanding features of the "undoubtedly extraordinary year." *Subject Headings:* **1. Rainfall amount 2. Rain intensities 3. Long period records 4. Santiago, Chile 5. Macul, Chile.**—*G.T.*

4.1–178 551.577.2(481)

*Norway. Meteorologiske Institutt, **Nedbøren i Norge, 1895–1943.** [Precipitation in Norway 1895–1943.] Oslo, [Sept. **1949**]. 2 v. Price: v. 1, Kr. 10.00; v. 2, Kr. 20.00. charts, map, tables. In English and Norwegian. **DWB**—This voluminous presentation of precipitation data for 825 stations in Norway consists of two volumes. In the first volume mean monthly and annual precipitation and departures from normal, mean number of days with precipitation and mean snow depth for the international "Normal Period" 1901–1930, and the mean monthly and annual precipitation for 1900–1940 (the normal period for the Norwegian Hydroelectric Service) as well as data on maximum 24 hr precipitation, maximum intensity of precipitation, number of days with snow cover, water content of snow and mean hourly precipitation (for 3 stations) with complete description of network, length of records, methods of compiling normals, etc. are given. A large station location chart is included and monthly and annual isohyetal charts appended in order to give a *general* idea of the normal rainfall distribution, even though the country is so rugged that such charts cannot be used for obtaining detailed information. In the second volume the actual monthly and annual data for the entire period of record for each of the 825 stations and the actual annual and seasonal amounts for each year figured from Sept. to Aug. (crop year) and from Dec. 1 to Nov. 30

(hydrological year) are given for the 825 stations. The text in v. I contains a great deal of interesting information about local and seasonal differences in precipitation in Norway. *Subject Headings:* **1. Precipitation data 2. Precipitation normals 3. Normal period (1901–1930) 4. Norway. I. Schou, Georg** (*ed.*) **II. Bruun, Inger** (*ed.*).—*M.R.*

4.1–179 551.577.2/3:551.506.3(691)

*Ravet, Jacques, **Les pluies à Madagascar.** [The rainfall in Madagascar.] *Madagascar. Service Météorologique, Publication*, No. 20, Jan. **1950.** 173 p. chiefly tables. **DWB**—Second of a series of publications on mean values of meteorological elements in Madagascar. Rainfall data from 57 observation stations are presented for the years 1931–1945, arranged in tables and graphs representing yearly, monthly, ten-daily, daily and hourly values and their variations. *Subject Headings:* **1. Rainfall variations 2. Rainfall distribution 3. Long period records 4. Madagascar.**—*G.T.*

4.1–180 551.577.2:551.582.3(931)

Seelye, C. J., **Maps of average rainfall in New Zealand.** Wellington, New Zealand, Meteorological Office, [n.d.] 18 p. entirely charts. **DWB**—Charts show isohyets of monthly and annual precipitation and average number of rainy days per year based on data for period from 1901–1930 (international "Normal Period") smoothed in the light of older records and shorter period records reduced to the 1901–1930 period. The charts are more detailed than those in Köppen-Geiger but for such rugged terrain cannot give the picture that would be obtained from the original data. Variations in average annual total range from <15 in. to >200 in. and from <2 in. to >20 in. in Dec. alone. *Subject Headings:* **1. Rainfall distribution 2. Rainfall frequencies 3. Atlases 4. New Zealand. I. New Zealand. Meteorological Service.**—*M.R.*

4.1–181 551.577.2/3(931)

*Seelye, C. J., **Variations of monthly rainfall in New Zealand.** *New Zealand. Meteorological Service, Meteorological Office Note*, No. 30, **1947** [9 p.] 6 tables, 2 figs., 6 refs. Reprinted from: *New Zealand Journal of Science and Technology, Sec. B*, 27(5):397–405, **1946. DWB**—A statistical study of variations in monthly rainfall from year to year, based on thirty years of record (1911–40) for 91 stations (adjusted in some cases). The *average* average variability for New Zealand is 44% around the monthly average, but *extreme* average variabilities of 77% (Jan.) or 18% (May) have been noted. The required distribution for each month is shown on 12 separate charts of New Zealand. Feb. is the most variable and July–Sept. the least, as a rule. The rainfall distribution is extremely skewed in many places: 74% of the months being below normal and 26 above. Persistence of dry and wet months and probabilities are also calculated and presented in tables. *Subject Headings:* **1. Rainfall variations 2. Rainfall distribution 3. Persistence 4. Statistical studies 5. New Zealand.**—*M.R.*

4.1–182 551.577.3(265)

*Seelye, C. J., **Rainfall and its variability over the central and southwestern Pacific.** *New Zealand Journal of Science and Technology, Sec. B*, Wellington, 32(2):11–24, Sept. **1950.** 10 figs., 5 tables, 8 refs. Also: *New Zealand. Meteorological Service, Meteorological Office Note*, No. 35. **DWB**—The discussion is centered around a series of maps which convey the following rainfall information: average annual rainfall, the frequency of wet months with over 150 per cent of average rainfall and of dry months with under 50 per cent of average, the last being treated seasonally as well as annually. Some notes are made concerning surface winds in some exceptional rainfall years, on the persistence of dry months and on some selected periods of abnormal rainfall. Throughout, the equatorial dry zone with its southeastern extension figures prominently as a homogeneous region and this emphasizes the anomaly that unmodified Tm air reaches the equator in that region without showing a transition to an Em air mass as would be customary elsewhere. *Subject Headings:* **1. Rainfall variations 2. Rainfall frequencies 3. Rainfall extremes 4. Equatorial dry zone 5. Southwest Pacific.** —*Author's abstract.*

4.1–183 551.577.32(84)

Negretty, José J. Rico, **Variaciones de las precipitaciones anuales en Bolivia.** [Annual precipitation variations in Bolivia.] *Revista Meteorológica*, Montevideo, 8(29):277–296, April **1949.** 8 figs., 5 tables, 8 refs. **DWB**—The cyclical variations of annual precipitation in the Altiplano and in the valleys follow the laws of variation of equal phase. There appears to be a long term decrease in precipitation in the Altiplano and valleys balanced by an increase in the plains area. First hints of a possible 13 year periodicity in rainfall amounts for Altiplano and the valleys are beginning to appear but should not be taken too seriously as yet. *Subject Headings:* **1. Precipitation variations 2. Periodicities 3. Bolivia.**—*M.P.K.*

4.1–184 551.577.34:551.577.2(931)

*Seelye, C. J., **Fluctuations and secular trend of New Zealand rainfall.** *New Zealand Journal of Science and Technology, Sec. B.*, Wellington, 31(6):11–24, May **1950.** 4 figs., 3 tables, 6 refs. Also: *New Zealand. Meteorological Service, Meteorological Note*, No. 36. **DWB**—Rainfall over the Dominion and each island is summarized into an annual index, the 1911–40 mean being taken as 100. The dispersion of rainfall amongst stations in a given year is briefly discussed. The fluctuations in index from year to year are resolved into a longer period which correlates closely with the 11-year sunspot cycle and a shorter more irregular period averaging three years. The indices for 1863 to 1947 show a declining tendency at the average rate of at least four per cent and two per cent per century for the North and South Islands respectively, but such a trend implies a bias in the method of evaluating indices before 1890 and a reasonable adjustment increases these trend rates to about seven and three per cent per century. *Subject Headings:* **1. Rainfall index 2. Rainfall distribution 3. Rainfall cycles 4. Sunspot cycles 5. New Zealand.**—*Author's abstract.*

4.1–185 551.577.32(84)

Escobar Vallejo, Ismaél (*Dir. Servicio Meteorológico, Bolivia*), **Régimen anual de precipitación en Bolivia.** [Annual precipitation regime in Bolivia.] *Revista Meteorológica*, Montevideo, 8(29):247–268, April **1949.** 2 figs., 6 maps, 30 refs. **DWB**—The annual geographical distribution of precipitation in Bolivia is described and illustrated in some detail. Fronts, convection and orography are cited as the chief causes of rain. Daily and seasonal distribution is also discussed, with summer being found the rainy and winter the dry season. Maps but no data included. *Subject Headings:* **1. Precipitation variations 2. Precipitation distribution 3. Bolivia.**—*M.P.K.*

4.1–186 551.577.73(68)

*de Villiers, G. D. B. and Persse, J. A., **An investigation into the precipitation intensity at Stellenbosch and Groot Drakenstein.** *South Africa. Dept. of Agriculture. Fruit Research, Technical Series*, No. 25, **1950.** 54 p. 8 figs., 13 tables, ref., append. with 8 tables. **DWB**—Observational data for the two stations are given. The most precipitation occurs during the winter months. The frequency distribution of rainfall intensity over 24 hours in Stellenbosch is examined. More detailed investigations were made in Groot Drakenstein. (Rainfall intensity for 24 hours, 60, 10 and 5 minutes). *Subject Headings:* **1. Rainfall intensities 2. Observational data 3. Stellenbosch, South Africa 4. Groot Drakenstein, South Africa.**—*A.A.*

4.1–187 551.577.37:551.515.7(492)

§Van Ufford, H. A. Quarles, **Berichten uit de weerkamer. Regenval nabij het centrum van een hogedrukgebied.** [Reports from the Weather Bureau. Rainfall near the center of a high pressure area.] *Hemel en Dampkring*, 50(4):74–75, **1952.** 2 figs. **MH-BH**—On Feb. 25, 1952 heavy rainfall fell over Friesland and Groningen although the barometric pressure over Friesland amounted to 1034 mb and calm weather prevailed. The synoptic conditions over western Europe, in particular pressure and circulation in the upper atmosphere, are described with the aid of synoptic maps. The rainfall is tentatively attributed to a weak trough which may have brought about convergence and vertical air movement. *Subject Headings:* **1. Excessive rainfall 2. Anticyclonic rainfall 3. Synoptic studies 4. Netherlands.**—*I.L.D.*

4.1–188 551.577.61:625.7

Tanner, J. C., **Effect of weather on traffic flow.** *Nature*, London, 169(4290):107, Jan. 19 **1952.** 2 tables. **DLC**—Comparison of censuses of road traffic in Great Britain in a fine week (Aug. 1949) and a wet week (Aug. 1950) shows a high negative correlation with rainfall *Subject Headings:* **1. Precipitation effects 2. Road traffic.**—*C.E.P.B.*

RAIN AND SNOW

See also: Hail literature, effect of hail on aircraft (Souter and Emerson), 4.1–12; Pyrénées, lab. of experimental meteorology (Dessens), 4.1–70; Precipitation associated with Atlantic coast storm (Carr), 4.1–101; Forest influences on thermal balance over snow pack (Miller), 4.1–119; Mild and snowy winter, 1951–52 (Ludlam), 4.1–134; Severe winter, 1941–42 (Pelleboer), 4.1–135.

4.1–189 551.578.11:551.507

Blanchard, Duncan C., **Experiments with water drops and the interaction between them at terminal velocity in air.** General Electric Research Laboratory, Schenectady, Project Cirrus, Final Report, July 30, **1951.** p. 102–130. 15 figs., refs. **DWB** Suspension of water drops in a vertical wind tunnel permits close observation of the drops, their growth and breakup, subsequent internal circulation and reactions to turbulence and changes in air velocity. The design of the tunnel is given and a number of experiments described. Observations outside the wind tunnel will supplement results obtained from the experiments. Breakup of drops (especially large ones) is due to turbulence or sudden changes in air velocity. *Subject Headings* **1. Raindrop dispersion 2. Turbulence effects 3. Wind tunnel experiments.**—*G.T.*

4.1–190 551.578.11

Farley, F. J. M., **The theory of condensation of supersaturated ion-free vapour.** *Royal Society of London, Proceedings, A*, 212:530–542, **1952.** 3 figs., 2 tables, 10 refs., 37 eqs. **DWB** —It is shown that in a supersaturated atmosphere there is a critical size above which a drop will tend to grow larger. Hence, in air passing from saturation to supersaturation, small drops will evaporate and large drops grow until a steady distribution is set up in which I drops are formed per second. An expression for I is calculated and gives reasonable agreement with cloud chamber experiments. *Subject Heading:* **1. Drop formation.**—*C.E.P.B.*

4.1–191 551.578.11

Kopp, Walter, **Auswertung von Tropfenschreiberregistrierungen und Vergleich der Registrierungen benachbarter Stationen.** [Evaluation of raindrop recordings and comparison of records of neighboring stations.] *Germany. Deutscher Wetterdienst in der US-Zone Berichte*, No. 35:312–316, **1952.** 6 figs. **MH-BH**—Records of an instrument at Darmstadt are illustrated and their analysis described. Simultaneous records at Darmstadt and Gimbsheim (Rhine) are compared. *Subject Headings:* **1. Rain structure 2. Rainfall data analysis.**—*C.E.P.B.*

4.1–192 551.578.11:681:77

Lane, W. R. (*Chem. Defence Exp. Est., Porton, Eng.*), **Shatter of drops in streams of air.** *Industrial and Engineering Chemistry*, 43(6):1312–1317, June **1951.** 7 figs., 13 refs. **DWB**—Electronic flash and spark photography was used in a study of the air stream required to break water drops of 5.0 to 0.5 mm and of the velocity of the drop at the instant of breaking. The results are formulated in equations. Photographs of the process of breakup are presented. The apparatus used is described and shown on diagrams. The study was extended to air flow at very high (supersonic) speed. The article is included in a symposium on "Dispersions in Gases" which contains a series of papers mainly concerned with industrial spray analysis. *Subject Headings:* **1. Drop shattering 2. Supersonic air speeds 3. Photographic measurements.**—*G.T.*

4.1–193 551.578.11

Ogiwara, S. and Sato, Y., **On the drop size of rain from clouds formed of water particles alone.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(8):274–280, Aug. **1951.** fig.

tables, 14 refs. In Japanese, English summary p. 280. **MH-BH**—From observations of ze of raindrops in relation to cloud type, authors conclude that drops up to 1.5 mm diameter an be formed in clouds without ice crystals. The mechanism is briefly discussed. *Subject leading:* **1. Rain from nonfreezing clouds.**—*C.E.P.B.*

4.1–194 551.578.11:551.573

Shvets, M. E., **Ob isparenii kapli v potoke.** [On evaporation of drops in an (air) current.] *J.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, :37–41, **1951.** fig., 6 refs., 16 eqs. **DLC**—An analysis of evaporation processes of a spherical rop with average value of Reynold's numbers for the stream blowing around the drop. The uthor determined mathematical expressions for the evaporation of an immobile drop, the vaporation in a flow of moderate speed and the changes of radius of a drop during its fall. *ubject Heading:* **1. Evaporation of raindrops.**—*N.T.Z.*

4.1–195 551.578.4:629.13(43)

†Bekker, M. G., **Snow studies in Germany.** *National Research Council of Canada. Associate Committee on Soil and Snow Mechanics, Technical Memorandum*, No. 20, May **1951.** 3 p.+94 figs. Photos, diagrs., tables, 200 refs., eqs. Mimeographed. **DWB**—A summary f knowledge gained by the Germans between 1939 and 1945 on the physical properties of snow s applied to snow removal on the "Autobahn" and from airports. A snow research station as set up near Munich in 1939 and both fundamental and applied research carried out there, ith no expense spared, from 1940 to 1945. Effect of air currents on drifting of snow along ow fences, and the crystalline structure, density, moisture content, friction, strength, etc. of ow were studied. A good bibliography and many photographs and graphs show sources, quipment and characteristics of snow. *Subject Headings:* **1. Snow structure 2. Snow removal . Snow accumulation 4. Aeronautical meteorology 5. Germany.**—*M.R.*

4.1–196 551.578.41

Vemić, M., **Otisci snežnih kristala.** [Snow crystal imprints.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorologiški Glasnik*, 1(1):22–27, Aug. **1948.** 7 figs. In Serbian. **DWB**—A report on experimental work at the observatory in Sarajevo. The trial use of moked paper for imprinting snowflakes showed good results since thawing snow crystals ave their marks on the paper in the form of the crystals. *Subject Heading:* **1. Snow rystal imprints.**— *N.T.Z.*

HYDROMETEOROLOGY

See also: Stage predictions for flood control (King), **4.1–69**

4.1–197 551.579:551.588(47)

Budyko, M. I., Drozdov, O. A. and IUdin, M. I., **K voprosu o kolichestvennom raschete zmenenii prirodnykh uslovii.** [On the question of quantitative calculation of changes of atural conditions.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr.*, No. 2:57–61, **1951.** 7 refs. **DWB**—Authors stress importance of soil science, geomorphology and physical eography in solving problems of hydrometeorology related to conservation and amelioration f natural conditions. Possibilities of changing climatic conditions are being studied by umerous workers in the Hydrometeorological Service of the U.S.S.R. Snow retention, forest elts, etc. are being actively studied. *Subject Heading:* **1. Climatic control 2. Conservation . Hydrometeorology.**—*M.R.*

4.1–198 551.579:551.573(6)

Grinsted, W. A. (*Met. Dept. Nairobi, Kenya*), **Infiltration, evaporation and transpiration—spects of particular interest to the meteorologist.** (In: African Regional Scientific Conference, ohannesburg, Oct. 17–28, 1949, 2:62–64, **1950.** In English, French summary p. 62.) **DWB**—A brief description of work on measuring actual evaporation from soil in East Africa. This ethod involves the determination of moisture in a large isolated cylinder of soil by sampling arious depths using the resistance of clay blocks as the moisture indicator. It is proposed to neasure temperature and humidity gradients in the lower 25 ft of the atmosphere in order to

determine evaporation and transpiration; the procedure consists of measuring radiation with a Star pyranometer and correlating amount of radiation with amount and dates of rainfall, soil cover and soil characteristics. *Subject Headings:* **1. Soil moisture 2. Radiation effects 3. Evapotranspiration 4. East Africa.**—*I.L.D.*

4.1–199 551.579:551.43

Lagaye, Jean de (*Puy de-Dôme Obs.*), **Les indices d'aridité dans le Département du Puy-de-Dôme.** [Aridity index for the Department of Puy-de-Dôme.] *Congrés des Sociétés Savantes, Nancy, 1950, Comptes Rendus*, p. 19–21. [1951?] table, graph. Stamped on cover title: *Puy-de-Dôme. Observatoire, Publications, Sér. B*, No. 1, **1952.** *Idem*, 4 p. table, 2 graphs. Stamped on cover title: *Puy-de-Dôme. Observatoire, Publications, Sér. B*, No. 3, 1951. **DWB**—Annual mean aridity indexes for the stations Puy-de-Dôme (1450m) and Clermont (405m) are computed from the annual water level, divided by the annual mean temperature plus 10°C. The annual indexes for the period 1880–1949 are tabulated and arid or humid periods determined. Curves of monthly mean aridity index for the two stations and for Saint-Anthème (950m) are presented and it is found that the lower situated stations show but slight variation within the year, whereas the higher station's aridity index is high in summer and low in winter. Annual mean aridity indexes are also presented for 62 stations, computed from periods of at least 10 years. A formula is developed to indicate the variation in aridity as a function of altitude and deviations of actual indexes from theoretical values are given. Theoretical curves of monthly variation in aridity with altitude are presented. *Subject Headings:* **1. Aridity index 2. Water level variations 3. Temperature variations 4. Orographic effects 5. Puy-de-Dôme, France.**—*G.T.*

4.1–200 551.579:061.3(436)

Lauscher, Friedrich, **Bericht über die Hydrographen-Tagung 1951 in Wien am 8. und 9. XI.1951.** [Report on the hydrographic conference in Vienna, Oct. 8 and 9, 1951.] *Wetter und Leben*, Vienna, 3(11/12):269–270, Dec. **1951. MH-BH**—Some of the subjects discussed included mathematical aspects of hydrography (FELBER and KRESSER), flood prediction (KREPS) and the Hydrometeorological Service of Norway (LAUSCHER) of which a detailed summary is given. *Subject Headings:* **1. Hydrographic conferences 2. Flood forecasting 3. Hydrometeorological services 4. Vienna, Austria.**—*I.L.D.*

4.1–201 551.579

*Norway. Vassdrags- og elektrisitetsvesenet. Hydrografiske avdelingen, **Hydrografiske undersøkelser i Norge; utdrag av det hydrografiske materiale for 40-årsperioden 1/9 1900–1/9 1940.** [Hydrographical investigations in Norway; selections from the hydrographical material for the 40 year period, 1900–1949.] Oslo, I kommisjon hos H. Aschehoug, **1947.** 225+p. photos, 2 fold. col. maps, graphs, tables. Introd. also in English. Price: Heftet Kr 15,00; Innbr. Kr. 18,00. **MH-BH**—Voluminous statistical tables of results of hydrological surveys and investigations in Norway with catalogue of stations, discussion of conditions, methods of stream flow measurement, history of investigations (since 1820) of runoff, levels of lakes, stream flow, precipitation, etc. Many excellent charts, graphs and photographs are included. *Subject Headings:* **1. Precipitation 2. Runoff 3. Hydrologic networks 4. Norway.**—*M.R.*

4.1–202 551.579 551.481

Renqvist, Henrik, **Suomen sisävedet.** [Inland waters of Finland.] *Finland. Hydrografiska Byrån, Hydrografisen Toimiston Tiedonantoja, Meddelanden*, 13:145–180, **1951.** 22 figs., 6 tables, 6 refs. Abstracted from reprint. **DWB**—A nicely edited study of the characteristics of inland waters (lakes and rivers) in Finland, based on records obtained in many parts of the country. Data are analyzed by regions or watersheds and presented in tables and charts, as well as being interpreted by means of analytical graphs, showing variations with time and other factors. *Subject Headings:* **1. Hydrology 2. Limnology 3. Finland.**—*M.R.*

4.1–203 551.579 551.582.2(728.5

*U. S. Nicaragua Canal Commission, 1932–1950, **Hydrological data of watershed area for proposed Nicaraguan Canal, 1932–1950.** Managua, Sept. **1951.** 74 p. 2 charts, chiefly

ables. **DWB**—A sketch of the history of the proposed Nicaragua Canal precedes the tabular material. Although much of the data was collected during the years 1932–1950, in many cases it is for a longer period, e.g., rainfall data for Granada is for 57 yrs (1877–1950). In most cases the data gives monthly, annual and overall averages for rainfall (18 stations), evaporation (5 stations), pressure (3 stations), temperature (5 stations), humidity (3 stations), wind (3 stations) and river discharges (2 rivers). Maps show location of the stations and topography of the area. *Subject Headings:* **1. Climatic data 2. Hydrologic data 3. Nicaragua.**—*M.L.R.*

4.1–204 551.579:626.8(661)

Hiehle, Kurt, **Die Bewässerung der Sahara.** [The irrigation of the Sahara.] *Umschau*, 52(17):517–520, Sept. 1, **1952.** 3 figs. **DLC**—Only 2 depressions in the Sahara are below sea level and flooding them from the Mediterranean would produce only unimportant changes of climate. Borings and tunnels into water-bearing layers could give only small supplies. Most of the Sahara will remain unusable; possibilities are damming the mountain streams and deflecting water from southern rivers. *Subject Headings:* **1. Irrigation 2. Reclamation projects Sahara Desert.**—*C.E.P.B.*

4.1–205 551.579.1

Samuel, Edward, **Water engineering in Australia.** *Water and Water Engineering*, London, 55(674):123–131, April **1952.** 11 photos. **GB-MO**—Account with photographs of the water storage dams and irrigation projects in different parts of Australia and reference to hydro-electric schemes. *Subject Headings:* **1. Water supply 2. Australia.**—*C.E.P.B.*

4.1–206 551.579.4:632.181(445)

Duffaut, J. and Avril, P., **Crue exceptionelle sur la Seuge le 16 juin 1951.** [Exceptional flood of the Seuge River on June 16, 1951.] *La Houille Blanche*, Grenoble, v. 7, Special No. A: 151–167, March **1952.** 3 figs. English summary p. 114–115. **DLC**—The case history of an exceptionally high flood in the Haute Loire Department, central France, is presented and the damage caused indicated. Precipitation amount at 8 locations is tabulated. The average flow is estimated (at 2.5 $m^3/sec/km^2$ for a surface of 150 km^2) from the water level and the size of the river bed and dam, a cross section of which is shown in a diagram. The effect of the flood on the Allier River, of which the Seuge is a tributary, is mentioned. A summary of a discussion by experts present at the conference, to which the report was addressed, is appended. *Subject Headings:* **1. Floods 2. Flood damage 3. Precipitation effects 4. Seuge River, Central France.**—*G.T.*

4.1–207 551.579.4

Flora, Snowden Dwight, **The great flood of 1844 along the Kansas and Marais des Cygnes Rivers.** *Kansas Historical Quarterly*, Topeka, Kansas, 20(2):73–81, May **1952.** 6 refs. **DWB.** Also: manuscript form. **DWB**—High water marks indicate that the flood of 1844 was five to six and a half ft higher than the flood of 1951. The cause of this flood was prolonged and heavy rains over a wide area. *Subject Headings:* **1. Floods 2. Kansas River floods Kansas.**—*A.A.*

CLIMATOLOGY AND BIOCLIMATOLOGY

CLIMATOLOGY

See also: Weather, climate, life (Voigts), **4.1–17**; Maps of average rainfall, New Zealand (Seelye), **4.1–180**; Hydrological data for proposed Nicaraguan Canal, 1932–50 (U. S. Nicaragua Canal Commission), **4.1–203.**

4.1–208 551.582(569):6

Ardon, Ya'acov, **Harnessing the climate in Israel.** *Weather*, 7(6):176–177, June **1952. DWB**—Account of work on indoor climate, heat-insulating properties of building materials, use of solar energy, etc. at techno-climatological research station set up by Haifa Technion in May 1951. *Subject Headings:* **1. Applied climatology 2. Israel.**—*C.E.P.B.*

4.1–209 551.582:629.13(265/6

Croxton, J. H., **Notes on weather conditions over the Southern Hemisphere portion of t Australia-North America International air route.** Wellington, New Zealand, Meteorologic Service, Dec. **1950.** 16 p. Mimeographed. **DWB**—Wind distribution with height, a masses, fronts, tropical cyclones, temperatures, clouds, visibility, humidity and thunderstorm are discussed for separate sections of the air route from Sydney, Australia to Canada. Signif cant seasonal variations of weather in the Pacific are mentioned. No data included. *Subje Headings:* **1. Aeronautical climatology 2. Australia–North America International air rout 3. Southern Hemisphere 4. Pacific Ocean.**—*M.P.K.*

4.1–210 551.582:551.589.1(61

*§Dugast, G. (*Algiers Univ.*), **Les types de temps en Algérie du Nord.** [Weather types i Northern Algeria.] Algiers, **1951.** 67 p. charts, tables, 25 refs. **DWB** Synoptic weath situations are classified for summer and winter according to cyclonic and anticyclonic regime and 12 subtypes depending mainly on air flow (southerly, northeasterly, southeasterly fo anticyclonic winter); westerly, southwesterly, northerly and Tyrrhenienne depression type for the cyclonic (winter); Mediterranean (anticyclonic summer); sirocco southwest and Ty rhenienne depression (cyclonic summer). Frequency and succession of types and genera character of Algerian climate are discussed in concluding chapter. Synoptic examples give *Subject Headings:* **1. Synoptic climatology 2. Weather types 3. Algeria. I. Queney, Pa II. Algiers. Université. Institut de Météorologie et de Physique du Globe.**—*M.R.*

4.1–211 551.582(261.3)629.1

*Great Britain. Hydrographic Dept., **Baltic pilot vol. III comprising the Gulfs Finland and Bothnia, and the Åland Islands.** 4th ed. London, **1951.** 627 p. 33 plates, table **GB-MO**—"Meteorology," p. xl–lv, 53–67, includes full climatological tables for ports. *Su ject Headings:* **1. Local climatology 2. Baltic Sea.**—*C.E.P.B.*

4.1–212 551.582(93,943):629.1

*Great Britain. Hydrographic Dept., **Australia pilot vol. IV comprising the easter coast of Queensland from Sandy Cape to Cape York, with the offlying islands and reef including Great Barrier Reefs.** London, **1951.** 355 p. figs., tables. **GB-MO**—"Clima and weather," p. 32–47, gives a general description of the variations of the meteorologic elements, tracks of hurricanes, sea surface temperatures, etc. Full climatological tables a included for 4 coast towns between 23° and 15°S and for Willis Is. *Subject Headings:* **1. Loc climatology 2. Australia.**—*C.E.P.B.*

4.1–213 551.582(5

*Partanskiĭ, M. M., **Klimaticheskie usloviia russkoĭ chasti ostrova Sakhalina.** [Climat conditions of the Russian portion of Sakhalin Island.] *Geograficheskoe Obshchestvo, SSS Vladivostokskiĭ Otdel, Zapiski*, v. 3(20), No. 2:117–164, **1929.** 15 tables. **DLC.** Englis translation available at **DWB**—Monthly and annual mean and extreme values of the meteor logical elements are presented for 5 stations (Onor, Tymovskoe Experimental Station, R kovskoe, Zhonk'erskiĭ Miak and Aleksandrovsk) in Northern Sakhalin and an analysis given for each element. Soil temperature and snow cover data for the Tymovskoe Expe mental Station are especially interesting although Sakhalin is elongated in a N–S direction an is very narrow, there is little latitudinal variation, but great differences between East, Midd and West coasts because of cold and warm ocean currents. Wind frequencies from vario directions, temperature of various winds, elaborate soil temperature and snow cover data mak this a valuable study though based on a short period of record. *Subject Headings:* **1. Clima of Sakhalin 2. Climatic data 3. Soil temperature data 4. Sakhalin Island.**—*M.R.*

4.1–214 551.582:35

†§*Sauer, Jonathan D. and Rigby, Malcolm, **Weather and climate in Finland as relate to military operations.** *U. S. Air Weather Service, Report*, No. 645, July **1944.** 174 tables, diagrs., graphs, charts, bibliog. p. 68–174. **DWB**—The climate and weather of Finla are discussed and represented on numerous charts in terms of average pressure distribution an

f pressure patterns showing characteristic synoptic situations connected with eight principal e-air flow types. Data for cloudiness, ceiling, visibility, humidity, precipitation, snow cover, ing, sea ice, temperature, turbulence, surface and upper air wind, length of day, optical henomena, soil conditions, etc., are presented and discussed as to their effect on air operations, mphibious and ground operations and chemical warfare. Chapters on meteorological acilities and on forecasting techniques are added. The report includes some 96 tables and 6 charts. (Most of the data are presented in tabular form on charts.) *Subject Headings:* **. Synoptic climatology 2. Military climatology 3. Climate of Finland 4. Finland.**—*G.T.*

4.1–215 551.582.1/2(485)

§Germany. Reichsamt für Wetterdienst, **Flugmeteorologische Uebersicht über Schweden.** [Aviation meteorological survey of Sweden.] Berlin, **1943.** unpaged. 32 figs. **DWB**—An excellent contribution to the climatology of Sweden, prepared from the viewpoint of the ynoptic meteorologist serving aviation meteorology. Only a small amount of data are given ut numerous synoptic and climatic charts covering Sweden and a great part of Norway show he distribution of wind directions at the surface and at 1000 m in height, the actual isotherms, rost days, freezing and opening of lakes, frequency of different cloud heights and fog, rainfall listribution and average depth of snow cover, precipitation frequency, visibility, frequency of lays with snow cover, cloudiness and typical synoptic situations. *Subject Headings:* **1. Aero- autical climatology 2. Climate of Sweden 3. Synoptic climatology 4. Sweden 5. Norway.** —*A.A.*

4.1–216 551.582.2:551.506.3(77)

Baten, W. D. (*Mich. St. Col.*) and Eichmeier, A. H. (*U. S. Weather Bur. East Lansing*), **A summary of weather conditions of East Lansing, Michigan prior to 1950.** East Lansing, Michigan State College, Agricultural Experiment Station, Dec. **1951.** 62 p. 31 charts. **MH-BH, DWB**—Based on records made at Michigan State College from 1910–1948 and at Lansing Airport since 1948, charts are presented to show daily average and extreme values of emperature for 24 hours and for 12 hours during day (6 a.m.–6 p.m.) and night (6 p.m.–6 a.m.); verage and probability of precipitation for week, frequency of 24-hour precipitation amount or year and for growing season; number of days of precipitation in year and in growing season or each year 1910–1948, frequency distribution of days without precipitation, snowfall, wind, unshine, relative humidity, insolation, evaporation, growing season, soil temperature at 1–3 n. and 3 and 4·ft depths and cumulative degree days. No tabular data are given. *Subject Headings:* **1. Climatic data 2. Observational data 3. Long period records 4. East Lansing, ich. I. Michigan Agricultural Experiment Station.**—*M.R.*

4.1–217 551.582.2(569.4)

*Israel. Meteorological Service, **Climatological normals, Part one.** *Israel. Meteorological Service, Series A, Meteorological Notes*, No. 3, **1952.** 24 p. 2 maps, 12 tables. In Hebrew and English. **MH-BH**—Tables give mean monthly and annual rainfall for 150 cations, reduced to 1901–30, numbers of raindays and monthly rainfall as % of annual for 4 stations. Preliminary normals of mean maximum, mean minimum and mean daily tem- erature and daily range, temperature extremes, relative humidity, evaporation (Piché) and loud amount are given for 21 stations. Some comparisons with long period records are made. *ubject Headings:* **1. Climatic data 2. Israel.**—*C.E.P.B.*

4.1–218 551.582.2:69(94)

*Keough, J. J. (*Sydney*), **Selected Australian climatic data for use in building design.** *ustralia. Commonwealth Experimental Building Station, Sydney, Technical Study*, 36, pril **1951.** 95 p. map, tables. Price: 2 sh. **DWB**—The work consists mainly of tables or 83 stations giving information most frequently asked for by architects. They include or summer and winter—mean maximum and minimum temperature, days of maximum above below certain limits, minimum relative humidity, sunshine, rainfall, wet days, maximum ll in 5 min, rain-bearing and dust-bearing winds and notes on phenomena, strongest winds, c. *Subject Headings:* **1. Climatic data 2. Architecture 3. Australia.**—*C.E.P.B.*

CLIMATIC CHANGES

See also: Duration of very hot temp. (Court), 4.1–132; Remarks on cold winters (Hagelen), 4.1–133

4.1–219 551.583.14:523.74(52

Seki, K., **Secular change of the climate.** *Journal of Meteorological Research*, Tokyo 3(9):314–317, July **1951.** 2 figs. In Japanese. **DWB**—Curves show solar activity 1750 1950 and related weather conditions in Japan—especially number of days with snow and wit snow cover. *Subject Headings:* **1. Climatic changes 2. Sunspots 3. Snow cover 4. Japan.**— *M.R.*

4.1–220 551.583.14:634.94:52

Woundenberg, J. P. M., **De oude eik van Twickel. Bomen als weerkundige archiever** [The old van Twickel oak. Trees as weather archives.] *Hemel and Dampkring*, 50(4):66–6 **1952.** 2 figs. **MH-BH**—The author summarizes briefly the secular climatic changes fro 1700 to 1940 established by LABRIJN for the Netherlands and the use of tree rings for the stud of historical climates and describes the 400 year old van Twickel oak which yielded a 200 yea ring sequence. *Subject Headings:* **1. Dendrochronology 2. Climatic variations 3. Historic climates 4. Netherlands.**—*I.L.D.*

4.1–221 551.583.2(04)(4

Visser, S. W., **Het klimaat van Westeuropa in de mideleeuwen.** [The climate of weste Europe in the Middle Ages.] *Hemel en Dampkring*, 50(5):84–87, **1952.** fig. **MH-BH**—I this popular article the author reviews briefly the writings of F. W. C. KRECKE, C. E. P BROOKS, S. PETTERSSON and others on the evidence that the climate of western Europe wa milder during the Middle Ages than after the beginning of the 17th century and that the minc glacial period which began around 1600 lasted until 1850. *Subject Headings:* **1. Climate of th Middle Ages 2. Historical climates 3. Popular meteorology 4. Western Europe.**—*I.L.D.*

4.1–222 551.583.

Jenal, C. (*Kriens*), **Die Ursachen der Eiszeit.** [Causes of the ice age.] *Leben un Umwelt*, Aarau, Switzerland, 7(11,12):255–260, 265–268, Aug., Sept. **1951.** 3 figs., 10 ref **DLC**—The author reviews the principal works on this problem by P. BECK, GLYER, ALBE HEIM, W. LUDI and MILANKOVICH, and concludes that the causes of the ice age were th increase of precipitation and equalization of temperature between Arctic and tropics. At th lower latitudes relief was also an important factor. The uniformity of temperature acros latitudes was caused by astronomical factors. The history of the earth shows that the varia tions of precipitation depended on terrestrial processes. *Subject Headings:* **1. Ice age 2. Qua ternary climates.**—*N.T.Z.*

4.1–223 551.583.3:551.55

Odum, Howard T., **The Carolina Bays and a pleistocene weather map.** *American Journ of Science*, New Haven, Conn., 250(4):263–270, April **1952.** 3 figs., plate, 22 refs. **DWB**— "Bays" are elliptical depressions in coastal plain of E. Georgia, N. and S. Carolina. They ar oriented NW–SE, and are attributed to wind and wave erosion during strong glacial wind Assuming that in Jan. pressure at 10,000 ft resembled present, and mean temperature 0 10,000 ft varied from −20°C over ice edge to present (+15°C) S of Florida, Jan. surface pre sure distribution is reconstructed. Winds crossing isobars at 40° agree with major axes of Ba ellipses. *Subject Headings:* **1. Quaternary climates 2. Wind effects 3. South Atlanti States.**—*C.E.P.B.*

MICROCLIMATOLOGY

4.1–224 551.58

Abe, IZO, **An instance of micro-meteorological observation in the cultivation of rice plan by the direct sowing method.** *Iwate Meteorological Association, The Review*, p. 20–26, Nov **1951.** graphs. In Japanese, English summary in append. p. 3–4. **DWB**—Comparativ

data are presented for micrometeorological conditions prevailing in a field where rice was planted directly and a field where the transplantation method was used. It is found that the difference in temperature between fields treated in the two ways was more noticeable in the underground portion than on or above ground level. The plants grew better if directly planted and no inequality in germination or growth was observed, contrary to expectations. The experiment was carried on by the author in 1949 at the Tohoku Branch Farm of the Agricultural Experiment Station of Japan. *Subject Headings:* **1. Microclimatology 2. Rice culture 3. Tohoku, Japan.**—*G.T.*

4.1–225 551.584

Dobryshman, E. M., **O protsesse transformatsii nad mikrorel'efom.** [On transformation processes over microrelief.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik,* 1:42–46, **1951.** 3 figs., table, 3 refs. **DLC**—Theoretical study of the transformation of air currents flowing over microrelief with sharp contrasts in temperature. To simplify the procedure, the mathematical analysis is made only for a case with homogeneous air mass and steady temperature conditions of the underlying surface. The coefficient of turbulence in layer near the ground is assumed as linear function of height and the wind profile follows the logarithmic law. The solution of equation expressing the transformation of the air flow passing through a sharp contrast of temperature is given. These theoretical calculations have not been verified yet because of the absence of experimental data. *Subject Heading:* **1. Micrometeorology.**— *N.T.Z.*

4.1–226 551.584.1:551.552

Sekiguti, T., **Studies on local climatology (III).** *Papers in Meteorology and Geophysics,* Tokyo, 2(2):168–179, June **1951.** 6 figs., map. **MH-BH**—Presents a method for determining the prevailing wind direction in regions for which measurements are not available. It consists of measuring the bending direction of the top twigs of trees, which in this case were persimmon trees, during the growing season. The personal error in such estimated wind direction averaged ±15° but a good agreement was found between the subjective estimates and anemometric measurements. Data on wind direction at the Akaho Fan are presented in tables and on a map and the effect of topography upon the distribution of the estimated wind direction is analyzed. *Subject Headings:* **1. Local climatology 2. Wind direction 3. Topographic effects 4. Japan.**—*I.L.D.*

4.1–227 551.584.2:551.584.4:551.571.4

*Sekiguti, T., **Studies on local climatology (VI); humidity distribution and surface covers.** *Papers in Meteorology and Geophysics,* Tokyo, 2(2):180–188, June **1951.** 3 figs., 5 tables. **MH-BH**—Observations of relative humidity were made at Uchihara over a flat plateau surface dotted with marshy land, paddy fields, cultivated fields, forests and grasslands. Relative humidity was measured with Assmann's psychrometers from 1300 to 1600 h on Sept. 28, 1947. The observations at the 74 observation points were not simultaneous. The extent of the errors introduced by microfluctuations of atmospheric conditions and by differences in time are analyzed and a method of reducing observed values at different times to condition at a given time is presented. The variation in relative humidity ranged between 5 and 10% and the highest humidities were observed in forests, on paddy fields and bushland and the lowest over bare soil and grassland. *Subject Headings:* **1. Local climatology 2. Humidity distribution 3. Uchihara, Japan.**—*I.L.D.*

CLIMATIC CLASSIFICATION

See also: History of meteorological observatory, Hochobir, 2041m (Lukesch), 4.1–36; Importance of mountain observatories (von Ficker), 4.1–40

4.1–228 551.585:37(72)

Alcorta Guerrero, Ramón, **El uso de la sistema climatológico de Koeppen en las escuelas secundarias.** [Use of Köppen's climatological scheme in the secondary schools.] *Sociedad Mexicana de Geografía y Estadística, Boletín,* 70(1/3):345–354, July/Dec. **1950. DWB**—An

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attempt to eliminate the use of the Köppen system in the Mexican secondary schools in favor of an alternate use of the classifications of DE MARTONNE and THORNTHWAITE encountered opposition in the Mexican Association of Geography and Statistics. An exchange of letters between the latter and various educational officials on the merits of the various climatic classification schemes is reproduced. The retention of the Köppen scheme was achieved. *Subject Headings:* **1. Climatic classifications 2. Teaching of meteorology 3. Mexico. I. Köppen, Wladimir Peter II. de Martonne, Emmanuel III. Thornthwaite, Charles Warren IV. Mexican Association of Geography and Statistics.**—*I.L.D.*

4.1–229 551.585.53:551.577.38(691)

Duvergé, Pierre, **L'indice d'aridité à Madagascar.** [Aridity index at Madagascar.] *Madagascar. Service Météorologique, Publication*, No. 18:1–28, Sept. **1949.** 7 figs., 9 refs. Duvergé, Pierre and Boyer, A., **Essai d'application à Madagascar de l'indice climatique de Swain.** [Attempt to apply Swain's climatic index to Madagascar.] *Ibid.*, p. 31–44. charts, tables. **DWB**—(1) The aridity index $A=\frac{P}{T+10}$ (A=aridity, P=rainfall, T=temperature) developed by DE MARTONNE is applied to Madagascar. Results are shown in charts, curves and tables. Reference is also made to evaporation data and their evaluation. (2) The climatic index prepared for forestry purposes by E. H. F. SWAIN of Forestry Commission of New South Wales, Australia, is applied for the same purposes to Madagascar. The index is computed from figures representing duration of dry period, season in which driest month occurs, mean temperature of coldest and warmest month and annual mean precipitation. The indexes for Madagascar are presented in charts and tables with comments, and a comparison is made between homologous climatic conditions in Madagascar and Australia. *Subject Headings:* **1. Aridity index 2. Madagascar. I. de Martonne, Emmanuel II. Swain, E. H. F. III. Boyer, A.**—*G.T.*

BIOCLIMATOLOGY—APPLIED CLIMATOLOGY

See also: Weather, climate, life (Voigts), 4.1–17; Influence of trellis walls and soil cover on climate of forests, soil and plant development (Weger), 4.1–247

4.1–230 551.586:519.24

Heite, H. J., **Über die korrelationsstatistische Urteilsbildung.** [On the interpretation of statistical correlation.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:35–43, **1952.** 8 figs. Bertram, G., **Bemerkungen zur Korrelationsrechnung.** [Remarks on correlation calculation.] *Ibid.*, p. 43–48. 3 figs., table. **DWB**—HEITE describes methods of distinguishing between deterministic (real) and aleatory (chance) relations by correlation and regression. Examples: feverishness and pulse rate ($r=0.56$), blood-corpuscle count and "costa-reaction" (non-linear correlation). BERTRAM explains relative advantages of correlation coefficient, correlation ratio, contingency and maximal correlation as research tools. *Subject Headings:* **1. Bioclimatology 2. Statistical methods. I. Bertram, G.**—*C.E.P.B.*

4.1–231 551.586:577.1

Smith, C. L., **Environmental temperature and the glycogen content of the frog's liver (Rana temporaria).** *Nature*, London, 170(4315):74–75, July 12, 1952. fig. **DWB**—Significant increases of glycogen in males but not females were found during periods of relatively low temperature in autumn. *Subject Headings:* **1. Animal ecology 2. Frogs.**—*C.E.P.B.*

4.1–232 551.586:61

Ungeheuer, H., **Gibt es einen biologisch wirksamen Wetterfaktor?** [Is there a biologically active weather factor?] *Umschau*, Frankfurt a.M., 50(13):393–394, July **1950.** 6 refs. **DLC**—In this survey of research on the biological effect of weather, particular attention is given to the book "Bioklimatik" [Bioclimatology], v. 1 and 2, 1946 by M. CURRY (*see item* 4–134, April 1950, *MAB*), who gives an account of his experiments and concludes that changes in atmospheric ozone bear a direct influence on functions of the human body. Continuous

measurement carried on by the German Weather Service in the U. S. Zone with 2 Curry-Dirnagl automatic ozone recorders are claimed to prove that ozone content is considerably modified by vertical circulation of the atmosphere. *Subject Headings:* **1. Medical meteorology 2. Aran 3. Ozone effects. I. Curry, Manfred.**—*G.T.*

4.1–233 551.586:612

Buck, Alfred, **Die Bedeutung des Elektrodermatograms in der Meteorologie.** [The importance of the electrodermatogram in biometeorobiology.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 6:9–14, **1951.** 3 figs., 2 tables, 17 refs. **MH-BH**—REGELSBERGER's electrodermatogram measures the polarization resistance of the skin, which runs parallel with insensible perspiration. Observations were made 6 times a day for four weeks; curves of variations are shown and their statistical significance calculated. Results are compared with air mass calendar at Hanover. Most marked change was an increase of skin resistance with incoming of mT air. Importance of method for research emphasized. *Subject Heading:* **1. Medical climatology.**—*C.E.P.B.*

4.1–234 551.586:612:616

Sauberer, Franz, **Die heutige Bioklimatologie des Menschen.** [Contemporary human bioclimatology.] *Wetter und Leben*, Vienna, 3(11/12):241–247, Dec. **1951.** 9 refs. **MH-BH**—A review of the more important German studies on the effect of aperiodic atmospheric processes upon human beings that have appeared during the period 1938–1951. The author discusses the work of DE RUDDER, HELLPACH and BERG on the effect of individual meteorological factors such as temperature, fronts, etc., upon the appearance of chronic, acute and infectious disease manifestations in man; the work of SCHULZE and BORTELS on the effects of atmospheric electricity, solar activity, solar radiation and radioactivity include the "H" and "T" rays of BORTELS; the work of CURRY on "aran" and the relationship between weather and constitution type; and the "dynamic method" of approach to bioclimatology, namely a combination of experimental and statistical procedures. *Subject Headings:* **1. Medical meteorology 2. Human ecology.**—*I.L.D.*

4.1–235 551.586:612.2

Hellpach, W., **Variolabile und Statotoniker.** [Variolabile and statonic subjects.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:233–235, **1952. MH-BH**—"Variolabile" subjects are affected by all changes of weather, "statonic" only by long continued steady states. *Subject Heading:* **1. Weather sensitivity.**—*C.E.P.B.*

4.1–236 551.586:612.2

Winterstein, Hans, **Die Wirkung mittlerer Höhen auf den Organismus.** [The effect of moderate heights on the organism.] *Umschau*, Frankfurt a.M., 52(17):521–523, Sept. 1, **1952. DLC**—The causes of "low pressure sickness" are discussed—effect on eustachian tubes, lack of oxygen in the air and decrease of CO_2 in the blood. These have been studied at 3500–5000 m; at 1500–2000 m there are proportional effects. *Subject Headings:* **1. Atmospheric pressure effects 2. Mountain sickness.**—*C.E.P.B.*

4.1–237 551.586:612.275

Franke, K., **Witterungseinflüsse und Kreislauf.** [Weather influences and circulation.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:17–19, **1952.** 6 refs. **DWB**—Discusses effect of changes of air pressure, air mass or fronts on blood pressure or cardiac diseases through the vegetative nervous system. *Subject Headings:* **1. Atmospheric pressure effects 2. Heart diseases.**—*C.E.P.B.*

4.1–238 551.586:612.79(04)

Radosević, M. B., **Temperatura vasduha i mi.** [Air temperature and we.] *Yugoslavia. Hidrometeorološka Služba. Hidrometeorologiški Glasnik*, 1(1):31–35, Aug. **1948.** 2 refs. In Serbian. **DWB**—The author describes in popular style the variations of the temperature sensitivities of human skin and establishes the dependence of these sensitivities on wind

velocity and humidity of the air. *Subject Headings:* **1. Temperature sensitivity of skin 2. Wind effects 3. Humidity effects 4. Popular meteorology.**—*N.T.Z.*

4.1–239 551.586:615.8:06

Bericht über die "Klimatagung" in Wangerooge, vom 26.–27. August 1950. [Report on the climate conference . . .] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:1–49, **1952. DWB**—The 8th conference of the "Medical-statistical Working Society" of Hanover was opened by J. HARTUNG with a short address outlining the purpose and program, under the title "Climate, weather and disease." The contributions are abstracted separately. Each was followed by a discussion. *Subject Headings:* **1. Medical climatology 2. Conferences.** —*C.E.P.B.*

4.1–240 551.586:615.8

Goeters, W., **Allergische Erkrankungen des Kindesalters im Seeklima.** [Allergic diseases of childhood in a sea climate.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:7–13, **1952. DWB**—Discusses effect of sea air on catarrhal infections and eczema in children. Asthmatic cases include 82–86% quickly cured by sea air alone, 12–15% requiring auxiliary medical treatment and 1–2% climate-resistant. In general, sea climate and warm sea baths are effective in eczema. *Subject Heading:* **1. Climatotherapy.**—*C.E.P.B.*

4.1–241 551.586:616

Berg, Hellmut, **Meteorologische Einflüsse auf den gesunden und kranken Menschen mit besonderer Berücksichtigung der meteorotropen Krankheiten und der Wetterempfindlichkeit.** [Meteorological influences on healthy and sick men with special regard to meteorotropic diseases and weather sensitiveness.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:2–6, **1952. DWB**—Sets out difficulties of relating meteorological and medical processes. Weather brings out aches and pains but is not a direct cause; "free föhn" is quoted as an example. Mechanism is assumed to be action on vegetative nervous system. Methods of research are discussed. *Subject Headings:* **1. Medical meteorology 2. Weather sensitivity.**—*C.E.P.B.*

4.1–242 551.586:616

Hänsche, H. A., **Das Wesen der vegetativen Dystonie und ihre bioklimatische Beeinflussung.** [The nature of vegetative dystony and its influence by bioclimatology.] *Annalen der Meteorologie, Medizin-meteorologische Hefte*, No. 7:19–24, **1952. DWB**—Discusses causes of nervous diseases, including CURRY's "Aran" theory, lack of oxygen and excess heat or radiation. *Subject Headings:* **1. Medical meteorology 2. Aran.**—*C.E.P.B.*

4.1–243 551.586:631

de Villiers, G. D. B. (*Western Prov. Fruit Res. Station, S. Africa*), **Climate and the cultivation of vegetables (with special reference to the Cape Flats).** *Farming in South Africa*, Pretoria, Dec. **1945.** 3 p. photo, table. Also in: *South Africa. Dept. of Agriculture. Fruit Research, Popular Series*, No. 45. Abstracted from reprint. **DWB**—An annual precipitation of 30–40" with at least 20–25" during the six months of active growth is regarded as sufficient for successful vegetable growing. The temperature requirements of different vegetables and the influence of humidity, sunshine and wind are examined. Data of temperature, humidity and rainfall (3 years) are given for the station at Cape Flats. *Subject Headings:* **1. Agricultural climatology 2. Cape Flats, South Africa.**—*A.A.*

4.1–244 551.586:631

de Villiers, G. D. B., **Influence of climate upon fruit production.** *Farming in South Africa*, Pretoria, June **1943.** 4 p. 3 refs. Also in: *South Africa. Dept. of Agriculture. Fruit Research, [Technical] Series*, No. 4. Abstracted from reprint. **DWB**—The quantitative production of fruit is influenced by the winter temperature, the qualitative production by the summer temperature. The temperature and rainfall requirements of different fruits are discussed. *Subject Headings:* **1. Agricultural climatology 2. Crop yield 3. Fruit culture. I. South Africa. Dept. of Agriculture.**—*A.A.*

4.1–245 551.586:631

de Villiers, G. B. D., **Winter temperature and fruit yield.** *Farming in South Africa*, Pretoria, Aug. **1947.** 8 p. 4 figs., 2 refs. Abstracted from reprint. **DWB**—A short, but valuable paper. The fruit trees must have a sufficient winter rest. A very low yield will result if the winter temperature is too high. The fluctuations of the winter climate and the winter temperature requirements of different fruit trees are examined. A macroclimatological survey for western Cape Province is given. *Subject Headings:* **1. Winter temperatures 2. Crop yield 3. Climatic variations 4. Fruit culture 5. South Africa. I. South Africa. Dept. of Agriculture.**—*A.A.*

4.1–246 551.586:551.594

Reiter, Reinhold, **Bio-meteorologische Indikatoren von grossräumiger und prognostischer Bedeutung.** [Bio-meteorological indicators of large scale and prognostic importance.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:235–253, **1952.** 19 figs., table, 22 refs. **MH-BH**—For characterizing regional health effects of a prevailing weather type and forecasting changes 8–12 hours ahead, author finds infra-long wave disturbances of 10–50 and 5–12 kHz and the static atmospheric electric field good indicators. The first has a high correlation with motor accidents in Bavaria, the second with accidents 12 hours later. Long discussion. *Subject Headings:* **1. Bioclimatology 2. Atmospheric electricity.**—*C.E.P.B.*

ENVIRONMENTAL INFLUENCES

See also: Hygienic characteristics of air of Berlin (Flach and Würfel), 4.1–82; Forest influences on thermal balance over snow pack (Miller), 4.1–119; Quantitative calculation of changes of natural conditions (Budyko, Drozdov and IUdin), 4.1–197.

4.1–247 551.588.3:551.586.63

Weger, Nikolaus, **Beiträge zur Frage der Beeinflussung des Bestandsklimas, des Bodenklimas und der Pflanzenentwicklung durch Spaliermauern und Bodenbedeckung.** [The problem of influencing the climate of stands, the soil climate and the development of plants by means of trellis walls and soil cover.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 28, **1951.** 29 p. diagr., graphs, tables, refs. **DWB**—The discussion covers the following topics, viz.: the effect of reflected radiation of differently colored walls upon tomatoes and peaches, and grapevines; the effect of soil covers such as sawdust peat meal upon the daily march of soil temperatures; the effect of kaolin sand cover on the soil upon tomatoes in the greenhouse; the effect of kaolin sand and coal dust upon bush beans in the field; the effect of soil cover upon the daily march of temperature in the soil and in stands, and upon plant growth; the use of aluminum foil as a soil cover for cucumbers and bush tomatoes, the attendant radiation conditions, air temperature, soil temperature and soil humidity and the development of cucumbers and bush tomatoes; the use of glass fiber mats in the growing of bush tomatoes and bush beans and the attendant daily march of soil temperature and soil humidity. *Subject Headings:* **1. Soil climatology 2. Agricultural climatology 3. Soil cover I. Artificial influences.**—*I.L.D.*

4.1–248 551.588.6

Fel'dman, IA. I., **K voprosu o vliianii lesnykh ploshchadeĭ na obrazovanie mestnoĭ pogody taezhnoĭ zone Evropeĭskoĭ chasti SSSR.** [On the influence of forests on the formation of local weather in the taiga zone of European U.S.S.R.] *Akademiia Nauk, SSSR. Institut Geografii, Trudy*, v. 48, Voprosy Klimatologii, **1950.** p. 88–95. 2 tables, 15 refs. **DLC**—This study on influence of forests in the taiga zone of European Russia upon various local summer weather types associated with precipitation and cloudiness is based on 5-year record (1901–1905) of 19 stations located at some distance from the coasts. European Russia is divided into northwestern and northeastern sections, each homogeneous in respect to radiation and atmospheric circulation; correlations are calculated between percentage of forest area and frequency of local weather types. Forests are found to increase frequency of rainy weather types and to diminish frequency of weather types characterized by cloudy days with intermittent rainfall. The physical processes underlying these conditions are discussed; it is shown

that no correlation exists between forests and amount of summer rainfall. *Subject Headings:* **1. Climatology 2. Forest influences 3. European U.S.S.R.**—*I.L.D.*

4.1–249 551.588.6

Naegler, W., **Kann durch Bewaldung oder Entwaldung das Klima geändert werden?** [Can afforestation or deforestation change the climate?] *Naturwissenschaftliche Rundschau*, 5(7):294, July **1952. DWB**—Forests cannot increase moisture content of air, but in climates with seasonal rains may lengthen the rainy season. *Subject Heading:* **1. Forest influences.**—*C.E.P.B.*

MISCELLANEOUS APPLICATIONS

COSMIC INFLUENCES

See also: Meteors as probes of upper atmos. (Whipple), **4.1–15**; Atmospheric pressure changes and solar activity (Craig and Hawkins), **4.1–145**

4.1–250 551.590.21 523.7:06(47)

Sizova, Olga, **Saules fizikas konference Ļeņingradā.** [Conference on solar physics in Leningrad.] *Zinātņu Akademija, Riga, Vēstis*, 3(32):139, **1950.** In Lettish. **DLC**—A short account of the conference held December 12–18, 1949. Besides the usual boasting, we learn that a new index of solar activity is proposed in the place of WOLF's sunspot numbers which is connected with the cyclical changes on the sun's surface. In a series of reports the solar influence on climate and weather were treated. No detailed information is given. *Subject Headings:* **1. Solar physics 2. Conferences 3. Solar influences 4. Lettish language 5. Leningrad, U.S.S.R.**—*A.A.*

4.1–251 551.590.24

Lebon, J. H. G., **Meteorological observations during the total solar eclipse of 25 February 1952.** *Weather*, 7(6):174–175, June **1952.** table. **DWB**—Observations at Ratawi near Basra, in the desert. Temperature in sand (bulbs just covered) fell by 13°F and in shade 4½ ft above ground by 2½°. *Subject Heading:* **1. Solar eclipses.**—*C.E.P.B.*

4.1–252 551.590.24

Martin, L. H., **Effect of the annular eclipse of March 7, 1951, on radio-wave propagation.** *Nature*, London, 169(4296):361–362, March 1, **1952. DWB**—Substance of a paper at the New Zealand Geophysical Conference. Results in New Zealand confirm that UV radiation from the sun is the main cause of atmospheric ionization. *Subject Headings:* **1. Eclipses 2. Ultraviolet radiation 3. Radio wave propagation.**—*C.E.P.B*

4.1–253 551.590.25

Davies, D. A., **A supposed meteorite in East Africa.** *Weather*, 7(6):190–191, June **1952. DWB**—Account of a greenish flash and explosion on night of Nov. 24, 1951. Possibly a meteorite; also caused vibrations on seismograph at Entebbe. *Subject Headings:* **1. Meteor explosions 2. East Africa.**—*C.E.P.B.*

4.1–254 551.590.25:551.501.81

Greenhow, J. S. (*Univ. of Manchester*), **Characteristics of radio echoes from meteor trails. III. The behaviour of the electron trails after formation.** *Physical Society of London, Proceedings, B*, 65:169–181, **1952.** 10 figs., 2 plates, 17 refs., 11 eqs. **DWB**—Amplitudes of long duration echoes from meteor trails show, superposed on steady decrease due to diffusion fluctuations of period 0.04 to 0.4 sec. (at 8.4 m), attributed to distortion of the trail by turbulence. Turbulent winds of about 20 m/sec are inferred at heights of 80–100 km. *Subject Headings:* **1. Meteor trails 2. Radio echoes.**—*C.E.P.B.*

4.1–255 551.590.25:621.396

Kaiser, T. R. and Closs, R. L. (*Univ. of Manchester*), **Theory of radio reflections from meteor trails.** *Philosophical Magazine*, London, 43(336):1–32, Jan. **1952.** 16 figs., table

eqs. **DWB**—Discusses the evaluation of the reflection coefficient for backward scattering an electromagnetic wave from a cylindrical column of ionization and its application to echoes om meteors passing through the atmosphere. Two cases are distinguished: depending on ether the electron line density is less or greater than 10^{12}/cm. In the former, if the electric ctor is parallel to the trail, the echo decreases exponentially; if normal to the trail resonance ects occur. With greater electron density the column reflects like a metal cylinder. *Subject eadings:* **1. Meteor trails 2. Radio echoes.**—*C.E.P.B.*

OPTICAL PHENOMENA

See also: General meteorological optics (Neuberger), 4.1–6; Polarization of skylight (Sekera), 4.1–9

4.1–256 551.593.5

Jenne, Werner, **Das Phänomen "Blaue Sonne."** [The phenomenon "blue sun."] *llus*, 3(3):129–134, Aug. **1951.** fig., 7 refs. English summary p. 129. **MH-BH**—The thor summarizes German reports on the "blue sun" which was observed on Sept. 27, 1950. nadian newspaper reports attributing "blue sun" to extensive forest fires are cited and the ssage of this phenomenon from Canada to Western Europe is followed on the basis of news- per reports and is illustrated on a map. The "blue sun" phenomenon consisted of two stinct aspects: 1) blue color of sun and moon and 2) absence of solar glare. Evidence is ed to show that the "blue sun" was produced by the presence of dust of volcanic origin in the atosphere. A spectrographic analysis of the solar spectrum in the region 3800–4700 Å rried out by P. WELLMANN is cited as confirming the latter evidence. *Subject Headings:* **Blue sun 2. Smoke pall—Sept. 1950 3. Germany.**—*I.L.D.*

4.1–257 551.593.5

Wilson, R. (*Royal Observatory, Edinburgh*), **The blue sun of 1950 September.** *Royal tronomical Society, Monthly Notices*, 3(5):478–489, **1951.** 2 figs., 2 tables, 9 refs. **DLC**— ıe author was fortunate in obtaining three spectrograms of varying density on a photo- aphic plate at Edinburgh on Sept. 26, 1950 at 15:20h during a break in the overcast that scured the sun most of the time that the blue color was present. Comparison of blue and rmal solar spectrograms allows calculation and construction of an extinction curve for the ıe producing layer. The latter was found to be caused by Canadian forest fire smoke at an itude between 31,000 and 43,000 ft (airplane observations) and was thought to be due to electric particles of uniform size (globules of oil distilled from the wood) with other types of rticles filtered out in transit. The extinction curve covers the range from 3800–6300 Å. elation between diameter and refractive index is deduced, with density of particles estimated $N_0 \simeq 70$ cm^{-3}. A heavy nonselective obscuration was indicated as well as the selective tinction [due either to particles of large size (large ρ) or to heavily absorbing (conducting) rticles of smaller size; this might have been due to water drops with large ρ]. Experi- ental results give a good verification of scattering theory of MIE, VAN DE HULST, HOUGHTON d CHALKER, and others if based on assumption of an overall reddening. Observed blueing curred on long wave length and reddening on short wave length side (minimum at 4350 A). *bject Headings:* **1. Blue sun 2. Smoke pall—Sept. 1950 3. Extinction theory 4. Scattering eory 5. Spectrophotometric observations 6. Edinburgh, Scotland.**—*M.R.*

4.1–258 551.593.52:551.515.1

Thomas, Trevor M., **Green sky around dusk.** *Geographical Journal*, 118(2):241–242, ne **1952. DWB**—Rifts of greenish sky on coast of S.W. England or S. Wales are seen out 6 times a year, either in ridges in rear of secondary depressions or between secondary ld fronts to intense polar air depressions. Both are cases of a deep returning polar air eam. *Subject Heading:* **1. Sky light color.**—*C.E.P.B.*

4.1–259 551.593.55:551.521.3

Sato, I., **Studies on the twilight by the scattering.** *Meteorological Society of Japan, urnal, 2nd Ser.*, 30(1):1–22, Jan. **1952.** 21 figs., 9 tables, 6 refs. In Japanese, English

summary p. 1. **MH-BH** The theoretical basis is given and compared with observation made at the Tokyo Astronomical Observatory. Detailed tables are given for primary, second ary and total scattering. *Subject Headings:* **1. Twilight 2. Scattering of light.**—*A.A.*

4.1–260 551.593.5

Dubois, Jean, **Contribution à l'étude de l'ombre de la terre. Première partie.** [Con tribution to the study of the shadow of the earth. Part 1.] *Annales de Géophysique*, 7(2):103 135, April/June 1951. 22 figs., 8 tables. French and English summaries p. 103. **MH-BH–** The phenomenon called "Earth Shadow," occurring during twilight at the opposite of the sun is studied in the present Memoir. This first part contains a spectrophotometric work on th earth shadow, from the wave length 4,000 Å to the wave length 8,600 Å. Curves giving th brightness of anti-crepuscular sky are established: on the one hand, in function, of the wav length for a given height above the horizon, and, on the other hand, in function of the heigh for a constant wave length. The observations are always made in a vertical plane containin the sun. From these curves, the author shows that earth shadow, or more exactly "anti crepuscular arch" is only caused by selective absorption of ozone, for lengths corresponding t the Chappius band. *Subject Headings:* **1. Twilight sky brightness 2. Spectrophotometr 3. Earth's shadow.**—*Author's abstract.*

4.1–261 551.593.63(492

ten Kate, H., **Optische verschijnselen in April 1951.** [Optical phenomena in Apr 1951.] *Hemel en Dampkring*, 50(4):69 70, **1952.** 3 figs. **MH-BH–** A description, wit diagrams, of halos observed in Zeeland on April 18 and 20, 1951. *Subject Headings:* **1. Hal observations 2. Netherlands.**—*I.L.D.*

4.1–262 551.593.63(777

Rogers, R. A. (*Iowa State Teachers College*), **A rare halo spectacle seen in Iowa.** *Weather wise*, 5(3):69, June **1952.** 2 figs. **MH-BH** On Feb. 27 the author observed in the Ceda Falls-Waterloo area of Iowa an unusual display of halos which reproduced almost every par of the Petersburg halo of July 18, 1794 (described by HUMPHREYS in "Physics of the air") A description of the halos aided by a sketch of the observed forms is presented and the optica causes of halo are discussed. *Subject Headings:* **1. Halo observations 2. Iowa.**—*I.L.D.*

ELECTRICAL PHENOMENA

See also: Ions in atmosphere (Wait and Parkinson), 4.1–14; Waveforms of atmospherics (Caton and Pierce), 4.1–88; Abnormal E region ionization (Gerson), 4.1–89; Lightning and thunder (Zim), 4.1–112; Bio-meteorological indicators of large scale and prognostic importance (Reiter), 4.1–246.

4.1–263 551.594.2

Travers, V. J., **Electrical phenomenon observed in flight over southern England.** *Me teorological Magazine*, London, 81(958):121 123, April **1952.** fig., table. **DWB–** Describe runs through a Cu.Nb. at intervals of 2000 ft from 22,000 ft down, to collect cloud droplet The collector gave the observer shocks and a ball of lightning exploded in the cockpit. Tabl gives details of cloud structure. *Subject Headings:* **1. Electrical discharges 2. Cumulonimbu clouds 3. England.**—*C.E.P.B.*

4.1–264 551.594.22:621.315:550.37(436

Fritsch, Volker, **Geoelektrische Untersuchungen in der Blitzschutztechnik.** [Geo electrical investigations of the techniques of lightning protection.] *E und M, Elektrotechni und Maschinenbau*, Vienna, 67(5):142–147, **1950.** diagrs., graphs. Abstracted from reprint **DWB** A statistical study for planning and development of the Austrian electric power system The amount of damage by lightning (since 1946) is given, and the geoelectric structure of th earth's surface (conductivity) shown in charts and cross sections for Austria, and for differen types of soil in general. (*See also* 4.1–265 below.) *Subject Headings:* **1. Lightning damag 2. Transmission lines 3. Geoelectric investigations 4. Austria.** W. N.

4.1–265 551.594.221:699.8

Fritsch, Volker, **Geoelektrische Untersuchungen an Blitzerden.** [Geoelectric investigations on lightning grounds (rods).] *Beiträge zur Geophysik*, 62(3):164–207, **1952.** 45 figs., bles, eqs. **DWB**—An investigation of the resistance of different types of lightning rod rths to high frequency currents is summarized. After a theoretical discussion an experiental setup is described and the results of measurements in unfavorable situations are given. anges in the resistance due to season, frost, snow, rain, thaw weather and thunderstorms e illustrated. It is recommended that earths should be tested at different seasons in the st year, and in subsequent years at the most unfavorable season. *Subject Headings:* **1. Lightng protection 2. Geoelectric investigations.**—*C.E.P.B.*

4.1–266 551.594.223

Connor, R. D., **Lightning and the spark discharge.** *Science News*, London, 19:89–108, **951**]. 13 figs. **DLC**—The Townsend mechanism for the production of an electron stream tween oppositely charged plates is described. At higher air pressures a space-charge by oto-ionization controls the sparking and streamer formation. These experimental results e used in a discussion of lightning, including the distribution and origin of field and develop-ent stages shown by Boys camera. This excellent summary concludes with lightning strokes om tall buildings. *Subject Heading:* **1. Lightning.**—*C.E.P.B.*

4.1–267 551.594.25

Haslett, A. W., **Research report. Ice, rain and electric charge.** *Science News*, London, :115–118 [**1952**]. 5 refs. **DLC**—Non-technical account of recent measurements of ctric charge on rain drops and some suggestions about mechanism of charging rain drops d ice particles. *Subject Heading:* **1. Electricity of precipitation.**—*C.E.P.B.*

4.1–268 551.594.25

Workman, Everly J., Reynolds, S. E., Gill, E. W. B., **Production of electric charges on ter drops.** *Nature*, London, 169(4313):1108–1109, June 28, **1952.** **DWB**—Correspondence out experiments on potential differences at surface of freezing and thawing impure water ops, discussing whether it is limited to a few molecular diameters or due to a volume density charged ions frozen into the ice. *Subject Heading:* **1. Electricity of precipitation.**—*C.E.P.B.*

4.1–269 551.594.5:771

Herman, L. and Leinbach, H., **A photographic study of changes of the infrared emission the polar aurora.** *American Geophysical Union, Transactions*, 32(5):679–682, Oct. **1951.** igs., 2 tables. **DWB**—Report on results obtained from about 200 pairs of pictures of auroral ht at College, Alaska during March 1951. The pictures were taken simultaneously on a nchromatic film through green filter and on an infrared film through red filter, using a single pod. Three double sets of pictures are shown in photographs and relative intensities of rared and green pictures for two series indicated in tables. The pictures taken are claimed cover almost all auroral forms and to show noticeable changes in about 5% of the cases. is expected that this percentage, although apparently sufficient to justify the applicat on of e method, could be further improved by using shorter time exposure. *Subject Headings:* **Auroral photography 2. Infrared auroral emissions 3. College, Alaska.**—*G.T.*

4.1–270 551.594.7

Bureau, Robert and Vaury, Jean Jacques, **Enrégistrement des atmosphériques à bord du mmandant Charcot, Campagne 1950–1951.** [Recording of sferics on board the "Commandant Charcot," Expedition 1950–51.] *Académie des Sciences, Paris, Comptes Rendus*, 3(18):1049–1051, Oct. 29, **1951.** graph. **DWB**—Account of sferics recordings made ring the 3rd expedition of the French vessel Commandant Charcot to the Antarctic region d across the Pacific Ocean. Recordings were made with a mean value recorder and a hodic goniometer. African and American continental sferics centers were located and data tained for sparsely explored regions of the Pacific. Results are discussed in general terms. sample recording is presented. *Subject Headings:* **1. "Commandant Charcot" Cruise Sferics.**—*G.T.*

4.1–271 551.594.7:551.510.52:621.396.

Crain, C. M. and Gerhardt, J. R., **Measurements of the parameters involved in the theory of radio scattering in the troposphere.** *Institute of Radio Engineers, Proceedings*, New York 40(1):50–54, Jan. 1952. 5 figs., table, 6 refs., 2 eqs. **DLC**—Preliminary measures of the scale and the intensity of turbulence were obtained by direct measurements of the variation of the index of refraction and the associated temperature fluctuations from 10 in. to 50 ft above the ground. The observations have been carried out by the Electrical Engineering Research Laboratory of the University of Texas since 1948–49. It is shown that the instantaneous patterns of temperature, moisture or refractive index generally have a magnitude significantly greater than zero. Observations to 300 ft above the ground will be made. *Subject Headings:* **1. Radio scattering 2. Troposphere 3. Refractive index 4. Temperature effects. I. Texas University. Electrical Engineering Research Laboratory.** *W. N.*

4.1–272 551.594.7:535.3

Feinstein, J., **Tropospheric propagation beyond the horizon.** *Journal of Applied Physics* 22(10):1292–1293, Oct. 1951. fig., 5 refs., eq. **DWB**—Since the atmosphere possesses a gradient of refractive index, a partial reflection of wave energy is delivered beyond the horizon of the transmitter. To estimate the magnitude of the field produced by that reflection, from a hybrid ray and wave theory, is the purpose of this paper. *Subject Headings:* **1. Tropospheri reflection 2. Radio wave propagation 3. Radio transmission 4. Refractive index.**—*W. N.*

4.1–273 551.594.7:551.510.53

Landmark, Bjørn, **Polarization of radio waves reflected from the ionosphere.** *Journa of Atmospheric and Terrestrial Physics*, 2(4):254–255, 1952. 3 figs. **MH-BH, DWB**—Th z-component of radio waves at Tromsø was found to be polarized in the same way as th ordinary component. Positive correlation was found between axis ratio of polarization ellips and absorption index. Axis ratio varied markedly during polar magnetic storms and dis continuities. *Subject Heading:* **1. Ionospheric reflection.**—*C.E.P.B.*

PART II. SELECTIVE ANNOTATED BIBLIOGRAPHY ON THE THEORY OF TURBULENCE

By: *Malcolm Rigby, Mollie P. Kramer and Andrew Assur*

INTRODUCTION

"Turbulence" is not a field that can logically be classified into different categories or types such s "Mathematical turbulence," "Hydraulic turbulence," "Wind tunnel turbulence," "Aerodynamic urbulence," "Turbulence in the lower atmosphere," "Free air turbulence," "Astrophysical turbuence," etc., but rather it is a concept, a technique or an approach to the analysis and solution of roblems in every field of mechanics of particles, from the most microscopic to the most macroscopic, n the universe. Thus the classical theory of turbulence and the modern statistical theory of turulence can be applied equally to problems in the fields of cosmogeny, astrophysics, ionospheric, tratospheric or tropospheric movements, general circulation, dynamic climatology, micrometeorology, dispersion of gases or vapor in the atmosphere or over the sea, hydrometeorology, hydraulics, eronautical meteorology, or any other field of aerodynamics, and hydrodynamics concerned with the regular motion of fluids, or of solids through fluids, or fluids over solids or in troughs or ducts.

Because there are so many applications of turbulence theory to every aspect of meteorology, nd so much of the theory directed toward applications in one field has turned out to be equally seful, either directly or by analogy, to the solution of problems in another field, we have taken the iberty of selecting for this bibliography a number of classical and recent theoretical papers which ave proved of interest to meteorologists working in various meteorological disciplines, even though ome of the papers included are apparently non-meteorological in character (e.g. skin friction and urbulent flow in pipes). The number of such papers we have excluded is many times greater than hat which we have included, but it is hoped that the range of interest and application is representative of the range of interest that meteorologists themselves comprise.

Papers which dealt with that phase of turbulence in the atmosphere which would be of interest o airplane pilots or aviation meteorologists were included in the November 1952 special bibliography. Most of these papers were really concerned with bumpiness or gustiness rather than with aspects f meteorology to which turbulence theory could be applied.

The remainder of the papers—nearly a thousand in all—were divided arbitrarily into two rough ategories: a) those which dealt with the mathematical and statistical theory or with laboratory xperiments and b) those which were based on empirical data obtained in the field rather than in the aboratory, including those papers dealing with instrumental techniques, turbulent diffusion and xchange investigations, micrometeorological turbulence studies over land or sea, etc. From the irst group only the most representative papers were selected for inclusion. Most of those in the econd group are being included in the bibliography on *Turbulent Diffusion and Exchange* which will ppear in the February issue.

A few theoretical works used in the November 1952 bibliography are repeated in this compilaion. Other theoretical papers *not* referred to in this bibliography are as follows: G. I. Taylor (1915) tem 3K–7, (1918) 3K–10; D. Brunt (1920) 3K–12; L. F. Richardson (1920) 3K–13; A. Defant (1921) K–16; A. Friedman (1924) 3K–21; L. Prandtl (1932) 3K–30; H. Köhler (1933) 3K–35; H. Lettau 1939) 3K–52, and O. G. Sutton (1949) 3K–142—all in Vol. 3, No. 11, November 1952.

In Vol. 4, No. 2, February 1953 the following fundamental theoretical papers will appear: on Helmholtz (1873); Kepinski (1905); Taylor (1927); Wagner (1929); Davies (1931, 1951); Rossby (1932); Sutton (1932, 1937, 1949, 1951, 1953); Roberts (1933); Sverdrup (1936); Lettau 1937, 1947, 1949, 1951); Domingo (1938); Arakawa (1941); Bagnold (1942); Raethjen (1942); chmitz (1947); Frenkiel (1949, 1952); Schlichting (1949, 1950); Sherwood (1949); Takeda (1949); Ialstead (1951); Inoue (1951, 1952); Kampé de Fériet (1951); Koschmieder (1951); Ogura (1952); Priestley (1952); Theodorsen (1952); Yih (1952).

SUBJECT OUTLINE

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BIBLIOGRAPHY ON THE THEORY OF TURBULENCE

1873–1877

4A–1 532.5:551.511

Boussinesq, J., **Essai sur la théorie des eaux courantes.** [Essay on the theory of fluid flows.] *Académie des Sciences, Paris, Mémoires par Divers Savants*, 23(1), **1877.** 680 p. refs., eqs. **DLC**—In this monumental volume, which gives the full details of all of the work of the author in the field of hydrodynamics up to 1876 and a summary of the work of SAINT-VENANT, DARCY, (*see item* 4A–195), BAZIN, BOILEAU and others from 1828 to 1870, can be found the first mathematical expression of a "coefficient of turbulent flow" and of the criterion for stability of flow. The actual lecture on this subject was read before the Academy of Sciences in Paris on April 15, 1872, and was reported in the *Comptes Rendus*, v. 76, p. 924, on April 14, 1873. (This 22-page report is reprinted as a preface to the 1877 tome.) The author credits SAINT-VENANT (1851) with the first hint that turbulence and other complicated movements in water affect the laws of flow in certain sections of a channel, and that the coefficient of friction can vary from point to point in one section. BOUSSINESQ proposes (p. 7) the use of local mean velocities to study uniform flow and states that there are two kinds of currents (p. 8). He discusses the coefficient of internal friction ϵ and the intensity of turbulence (p. 46) and uses the term "isotropic" in characterizing the movements. The internal friction is expressed mathematically as a function of mean velocity on p. 90–92. He then introduces turbulent velocities to the equations of motion and concludes that a stability criterion must exist. The effect of waves on stability of flow had been studied by the author prior to 1869. The two types of flow: torrential and tranquil are defined mathematically on p. 131–134, and the circumstances for origin and destruction of uniform flow set forth on p. 199–207. A stability criterion proportional to the square of the mean velocity and the dimensions of the channel is proposed (p. 290–293). Conservation of the instability of flow is then treated (p. 378–401) and after calculating the energy of systems, eddies with vertical axes are discussed (p. 616–618) and differential equations for eddy motion are given on p. 621–627 and are integrated on p. 627–631, and, finally, the energy of an eddy is formulated on p. 632–634. *Subject Headings:* **1. Hydrodynamics 2. Turbulence theory 3. Origin of turbulence.**—*M.R.*

1883

4A–2 532.5:551.511

Reynolds, Osborne, **An experimental investigation of the circumstances which determine whether the motion of water shall be direct or sinuous, and of the law of resistance in parallel channels.** *Royal Society of London, Philosophical Transactions*, 174(3):935–982, **1883.** 9 figs., 5 tables. **DLC.** Also in his: **Papers on Mechanical and Physical Subjects.** v. 2. Cambridge, **1901.** p. 51–105. **DLC**—The most significant early paper in the field of turbulence theory. The author proved that there is a critical velocity which determines whether motion of a fluid will be laminar or turbulent and that the critical velocity decreases as temperature of the fluid increases, and developed a theory to explain why eddies are responsible for the variation of resistance as the square of the velocity. Explanation was deduced from experiments with: 1) eddies in water, the surface of which was covered with oil to prevent waves, 2) colored streaks in water flowing through glass tubes of various sizes and 3) observation of waves and eddies formed on the boundary surface between two opposite moving streams in a tube. Results given in extensive tables. REYNOLDS also showed that there were really two critical velocities, one for change from laminar to turbulent flow, and a similar one for change from turbulent to stable flow. The equations of motion were developed to formulate the experimental laws, and the methods of setting up the experiments described in detail and the equipment illustrated. DARCY's experiments on resistance to turbulent flow in pipes are described and verified. *Note:* Eddy or sinuous motion is mentioned often, but no reference to turbulent motion. (*Same item* as 3K–1, Nov. 1952, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Equations of motion 3. Hydrodynamics.**—*M.R.*

1895

4A–3 532.5:551.511

Reynolds, Osborne, **On the dynamical theory of incompressible viscous fluids and the determination of the criterion.** *Royal Society of London, Philosophical Transactions*, 186:123–164, **1895.** refs., 80 eqs. Also in his: **Papers on Mechanical and Physical Subjects.** v. 2. Cambridge, **1901.** p. 535–577. **DLC**—After reviewing the mathematical and experimental history of turbulence theory and its application to hydrodynamics, the author summarizes his own classical work presented in 1883 (*see* 4A–3 below). He then goes on to give a mathematical development of his later theories for defining the lower limit of change from turbulent to laminar motion, for determining the difference between mean motion and heat motion, and for determining the geometrical relation between mean mean motion and relative mean motion. The expressions for transformation of the energy of relative mean motion to heat motion, and of mean mean motion to relative mean motion are worked

out. Several special cases are also worked out. *Subject Headings:* **1. Turbulence theory 2. Reynolds numbers.**—*M.R.*

1901

4A–4 532.5:551.511

Reynolds, Osborne, **On the equations of motion and the boundary conditions for viscous fluids.** (In his: **Papers on Mechanical and Physical Subjects.** v. 2. Cambridge, **1901.** p. 132–137.) **Study of fluid motion by means of coloured bands.** (*Ibid.*, v. 2, p. 524–534.) **DLC**—The first paper is a brief note attempting to formulate the laws of momentum transfer from a wall to a gas or vice-versa, in the light of experimental evidence of forces > viscosity. Molecular dimensions are for the first time considered to be important in the laws of motion. A rigid layer of molecules adheres to the wall, and another layer is disturbed by that layer, etc., but the effect of the friction on the entire fluid motion is not that of one layer any more than the rigidity of a fishing rod is that of any one section, but lies between that and values obtained from previous formulas ignoring size of molecule. In the second paper earlier experiments with use of colored bands to demonstrate boundary layer wave, eddy and vortex motion in a tank of fluid are repeated and applications suggested for study of cloud formation and motion, study of winds and air currents as well as to the motion of ships through water. The subject of vortex rings is emphasized. *Subject Headings:* **1. Boundary layer 2. Equations of motion 3. Hydrodynamics 4. Fluid mechanics.**—*M.R.*

1910

4A–5 532.5:551.511

Ekman, V. Walfrid, **On the change from steady to turbulent motion of liquids.** *Arkiv för Matematik, Astronomi och Fysik*, Stockholm, 6(12):1–15, **1910.** 3 figs., tables, refs., 4 eqs. **DLC**—Experiments performed by the author are described which show the critical limit of stability for fluid motion in pipes at different temperatures. Fluctuations in pressure were also measured by means of ingenious apparatus, and finally the theory of "generation of disturbing vorticity." The velocity at which steady motion changes to "turbulent motion" is said to be 4 to 6 times higher than the theoretical limit of REYNOLDS. *Subject Headings:* **1. Laboratory turbulence models 2. Turbulent flow.**—*M.R.*

1922

4A–6 551.511:551.551

Bateman, H., **The decay of a simple eddy.** *U. S. NACA, Report*, No. 144, **1922.** 7 p. 25 eqs. **DLC**—A mathematical paper in which Taylor's formula is generalized for a simple eddy. It is shown that there is an analogy between the theory of eddies in a viscous fluid and the quantum theory of radiation, or a slight similarity between the energy decay in the turbulence and in the electro-magnetic spectrum. Another exact solution of the equations of variable motion of an incompressible viscous fluid is shown to have a similarity with the theory of instability of a horizontally stratified atmosphere when the lapse rate is superadiabatic. *Subject Headings:* **1. Turbulence theory 2. Turbulence decay.**—*M.R.*

4A–7 517.512.4:551.511

†Watson, George Neville, **A treatise on the theory of Bessel functions.** Cambridge, Eng., University Press, **1922.** 804 p. fig., 8 tables, bibliog. p. 753–788. **DLC**—The most comprehensive treatise on Bessel functions in the English language. In addition to theory and applications there are 90 pages of tables of Bessel functions, and 36 pages of bibliography, arranged by author, on items not only of purely theoretical interest, but on all manner of applications to science and engineering. For instance there are 8 pages by L. EULER, 6 by DANIEL BEMOULLI, 11 by H. LAMB, 8 by SIR G. STOKES, and some by LA GRANGE, GLAISHER, RAYLEIGH, KELVIN, KAMPÉ DE FÉRIET and many others—an excellent source of references. Contains solutions of differential equations for wave motion, fluid mechanics and viscosity. *Subject Headings:* **1. Bessel functions 2. Turbulence theory 3. Bibliographies.**—*M.R.*

1924

4A–8 551.511:551.551

Heisenberg, Werner, **Über Stabilität und Turbulenz von Flüssigkeitsströmen.** [On stability and turbulence of fluid flows.] *Annalen der Physik*, 74(15):577–627, **1924.** 3 figs., refs., 66 eqs. Translation in: *U. S. NACA, Technical Memorandum*, No. 1291, June **1951. DWB**—The author shows in a long mathematical discussion, based on STOKES' equations, that the laminar motion and its stability conditions are not important for the turbulence problem and the critical Reynolds number. In a second part the turbulent motion and the velocity distributions between walls is studied. The theory can give two REYNOLDS numbers, one for the beginning of turbulence, the

ther for the breakdown of laminar motion. *Subject Headings:* **1. Turbulence theory 2. Turbulent low 3. Reynolds numbers.**—*A.A.*

1925

4A–9 551.511:551.551

Keller, Leo, **Über die Aufstellung eines Systems von Charakteristiken der atmosphärischen Turbulenz.** [On the development of a system of characteristics of atmospheric turbulence.] *Zhurnal Geofiziki i Meteorologii*, Moscow, 2(3–4):275–288, **1925.** refs. **DLC**—Author derives a system of quantities which, with a sufficient degree of accuracy, describe statistically atmospheric turbulence, and of such a nature that if given at the time $t=0$ they may be computed for any subsequent time. KELLER's attempt is based on a generalization of REYNOLD's method for deriving the additional stresses within a turbulent moving fluid, and is applied to the case of adiabatic movement. *Subject Headings:* **1. Statistical theory of turbulence 2. Atmospheric turbulence.**—*M.P.K.*

4A–10 551.511:551.551

Prandtl, Ludwig, **Bericht über Untersuchungen zur ausgebildeten Turbulenz.** [Report on investigations of fully developed turbulence.] *Zeitschrift für angewandte Mathematik und Mechanik*, 5(2):136–139, April **1925.** 2 figs., refs., 10 eqs. **DLC.** Translation by J. Vanier, *U. S. NACA, Technical Memorandum*, No. 1231, Sept. 19, **1949. DWB**—A concise statement of the basic concepts of turbulence theory, beginning with the Blasius law of resistance proportional to 7/4 power of the mean velocity (at low Reynolds numbers) and the square of mean velocity at high Reynolds numbers. Then the concept of ϵ as austausch, and l as mixing length is developed. Finally, special application is made to the case of turbulence affected by smooth or rough walls and "free turbulence." Initial experiments in channels to test these laws are briefly described. The chief contribution of this paper is the formulation of the stress superimposed by turbulence on the straight two-dimensional mean motion of a fluid according to the following equation:

$$\tau = \rho l^2 \left| \frac{du}{dy} \right| \cdot \frac{du}{dy}$$

Subject Headings: **1. Turbulence theory. I. J. Vanier** (*trans.*).—*M.R.*

1927

4A–11 551.511

Taylor, Geoffrey Ingram, **An experiment on the stability of superposed streams of fluid.** *Cambridge Philosophical Society, Proceedings*, 23(6):730–731, **1927.** fig. **DLC**—A laboratory experiment was conducted to show the speed and distance from point of contact of two fluids of different density, at which turbulence sets in. Brine was used to represent the stable fluid (dense air in a cold pool) and water with colored dye to represent the warm overrunning layer of air. At low speeds the mixing was slight, but at higher speeds the mixing became complete, especially at some distance from point of contact. *Subject Headings:* **1. Turbulent flow 2. Laboratory turbulence models.**—*M.R.*

1929

4A–12 551.511:551.551

Burgers, J. M., **On the application of statistical mechanics to the theory of turbulent motion. Pts. I–III.** (*K.*) *Akademie van Wetenschappen te Amsterdam, Section of Science, Proceedings*, 32(4–6):414–425, 643–657, 818–833, **1929.** fig., 77 eqs. **Pt. IV.** *Ibid.*, 36(3):276–284, **1933.** 24 eqs. **DLC**—In the first part the author shows how statistical methods, requiring the introduction of a principle to allow the definition of probabilities of the various states of motion, can be applied to study of turbulent motion in wind tunnels. In Pt. II the conditions for dissipation of turbulent energy with respect to time (for mean motion) were formulated but found not to agree with experiment. In Pt. III it was found that better agreement was obtained by defining mean motion as a mean with respect to x or space rather than time. In the following 4th part the theory is critically extended in the light of the work of other authors (PRANDTL, VON KÁRMÁN, TAYLOR and others). *Subject Headings:* **1. Statistical theory of turbulence 2. Wind tunnel experiments 3. Turbulence decay.**—*M.R.*

4A–13 551.511:551.551

Prandtl, Ludwig, **Einfluss stabilisierender Kräfte auf die Turbulenz.** [Influence of stabilizing forces on turbulence.] (In: Gilles, A., Hopf, L. and von Kármán, Theodor (*eds.*), **Vorträge aus dem Gebiete der Aerodynamik und verwandte Gebiete.** Aachen, **1929.** p. 1–7.) Translation by J. M. Burgers, *U. S. NACA, Technical Memorandum*, No. 625, June **1931.** 11 p. Comments by J. M. Burgers, p. 8–11. **DWB**—As an analogy to the nocturnal stability of air masses or to the flow

of warm air masses over cold, and the opposite effect of heating from below in the daytime or when cold air flows over warm surfaces, the author sets up experiment wherein an air stream is blown between a water cooled and a vapor heated plate (at the suggestion of SCHMIDT), allowing the mechanism of atmospheric turbulence to be studied under controlled conditions. The theory of energy transfer and decay is developed briefly, but logically, and the ideas of mixing length, austausch, shearing stresses, etc. formulated. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of momentum 3. Laboratory turbulence models. I. Gilles, A.** (*ed.*) **II. Hopf, L.** (*ed.*) **III. von Kármán, Theodor** (*ed.*) **IV. Burgers, J. M.** (*trans.*).—*M.R.*

1930

4A–14 551.511:551.55

Ertel, Hans, **Die vertikale Druckverteilung in turbulenten Strömungen.** [Vertical pressure distribution in turbulent flow.] *Meteorologische Zeitschrift*, 47:222–227, **1930.** 7 refs., 24 eqs. **DWB**—The vertical distribution of pressure under natural conditions of turbulent flow is not the same as the static lapse of pressure, even when all flow is horizontal. The difference is purely an effect of turbulence. The theory is worked out along the lines of Hesselberg's development of the equations of atmospheric motion and austausch. (*Same item* as 2K–103, Nov. 1951, *MAB.*) *Subject Headings:* **1. Turbulent flow 2. Pressure distribution.**—*M.R.*

1931

4A–15 551.511:551.55

Ertel, Hans, **Zur Theorie der atmosphärischen Turbulenz.** [The theory of atmospheric turbulence.] *Zeitschrift für angewandte Mathematik und Mechanik*, 11(1):20–26, **1931.** 15 refs., 27 eqs. **DLC**—An attempt to formulate the laws of velocity distribution in turbulent flow on the basis of correlation between the horizontal and vertical velocity components, rather than on the simpler but unworkable basis of the Maxwellian distribution which HESSELBERG and WAGNER used for their theoretical development. Applications to the boundary (ground) layer of the atmosphere is suggested. *Subject Headings:* **1. Turbulence spectrum 2. Statistical theory of turbulence.**—*M.R.*

4A–16 551.55

Taylor, Geoffrey Ingram, **Internal waves and turbulence in a fluid of variable density.** *Conseil Permanent International pour l'Exploration de la Mer, Rapports et Procès-Verbaux des Réunions*, Copenhagen, 76:35–43, **1931.** 2 tables, refs., 10 eqs. Discussion, p. 42–43. **DWB**—The effect of the imposition of a disturbance on systems such as the atmosphere and the sea (in which stratification of density and relative motion of the various layers co-exist) is considered in relation (a) to internal waves (b) to the diffusion of properties like salinity, and temperature and (c) to the diffusion of momentum. *Subject Headings:* **1. Turbulence theory 2. Internal waves 3. Turbulent diffusion**—*M.P.K.*

1932

4A–17 551.511:551.55

Taylor, Geoffrey Ingram, **The transport of vorticity and heat through fluids in turbulent motion.** *Royal Society of London, Proceedings, Ser. A*, 135:685–702, **1932.** Fage, A. and Falkner, V. M. **Note on experiments on the temperature and velocity in the wake of a heated cylindrical obstacle.** *Ibid.*, p. 702–705. 4 figs., eqs. **DWB**—A searching test of the comparative merits of REYNOLD'S and PRANDTL'S "Momentum Transport" theory (*see item* 4A–13 above) and the author's "vorticity transport" theory is provided by comparing the distribution of temperature and velocity in the wake behind a heated obstacle. Author claims that measurements made at the National Physics Laboratory confirm his theory for the case of a two-dimensional motion when the turbulent motion is confined to the plane of the mean motion. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of vorticity. I. Fage, A. II. Falkner, V. M.**—*From author's abstract.*

4A–18 551.511:01

†Zahm, Albert Francis and Ross, Cecil Alured, **Bibliography on skin friction and boundary flow.** Washington, D. C., U. S. Library of Congress, Division of Aeronautics, Dec. 31, **1932.** 46 p. Entirely refs. **DLC**—Extensive, unannotated collection of references on surface velocity and friction of fluids in steady motion along solid boundaries at moderate Reynolds' numbers. Their main theme is the determination, by theory or experiment, of the velocity distribution in the boundary layer, and the attendant skin friction, of slightly viscous fluids such as air and water. *Subject Headings:* **1. Turbulent flow 2. Boundary layer 3. Bibliographies.**—*From authors' abstract.*

1933

4A–19 532.5:551.511

Bjerknes, Vilhelm Friman Koren; Bjerknes, Jakob; Solbert, Halvor Skappel and Bergeron, Tor, **Physikalische Hydrodynamik.** [Physical hydrodynamics.] Berlin, Springer, **1933.** 797 p. 151 figs., refs., eqs. **DLC.** French edition entitled: **Hydrodynamique physique, avec applications à la météorologie dynamique.** [Physical hydrodynamics, with applications to dynamic meteorology.] Paris, **1934. DLC**—Although dealing with the profound concepts of fluid motion theory, and using the advanced notation of vectors and tensors, this classical text progresses in a simple and orderly fashion from a definition of the terms and notations to a theoretical treatment of the basic concepts of dynamic meteorology, movements of parcels in a continuous medium, movements of lines, dynamics of stationary vortexes, annular vortexes, wave motion, the equations of motion and of equilibrium, discontinuity surfaces, isobaric surfaces in stationery systems, and convective cells (closed system). *Subject Headings:* **1. Hydrodynamics 2. Turbulence theory 3. Textbooks.**—*M.R.*

4A–20 551.511:551.551

Köhler, Hilding, **Meteorologische Turbulenzuntersuchungen.** [Meteorological turbulence investigations.] (*K.*) *Svenska Vetenskapsakademien, Stockholm, Handlingar*, 3rd Ser., 13(1), **1933.** 54 p. 3 figs., 36 refs., 74 eqs. **DLC**—A mathematical investigation of turbulence based on the classic work of REYNOLDS and LORENTZ in application to meteorology, considering the Coriolis force. Assuming a power law for the vertical distribution of the "virtual friction" coefficient $\eta = \eta_0 Z^{(p/p+1)}$, the author discusses the conditions near the ground. The angle between the gradient and the wind direction is found independent of latitude, but varying with p. The direction of the friction force is computed and the meaning of η discussed, which is not identical with the austausch coefficient. *Subject Headings:* **1. Turbulence theory 2. Wind deviation.**—*A.A.*

4A–21 551.511:551.551

†Prandtl, Ludwig, **Neuere Ergebnisse der Turbulenzforschung.** [Recent results of turbulence research.] *Verein Deutscher Ingenieure, Zeitschrift*, 7(5):105–114, Feb. 4, **1933.** Translation by Dwight M. Miner, *U. S. NACA, Technical Memorandum*, No. 720, Aug. **1933.** 27 p. 10 figs., 38 refs. **DLC**—The paper reviews the most important research up to 1932, on origin of turbulence, characteristics of turbulence currents, boundary layer flow and velocity distribution on rough and smooth surfaces. *Subject Headings:* **1. Turbulence theory 2. Bibliographies 3. Origin of turbulence. I. Miner, Dwight M.** (*trans.*).—*M.R.*

4A–22 551.511:551.551

Schlichting, H., **Zur Entstehung der Turbulenz bei der Plattenströmung.** [On the origin of turbulence at flow between plates.] *Gesellschaft der Wissenschaften zu Göttingen, Math.-Physik. Klasse, Nachrichten*, No. 2:181–208, **1933.** 3 figs., 4 tables, 24 refs., 42 eqs. **DLC**—A systematic presentation of the theoretical aspects of turbulence origin through small oscillations in velocity produced by the boundaries or walls of a channel. The general perturbation equations are developed, followed by the solution for frictionless motion with linear and parabolic velocity fields in the main current, and then the formulation and solution of the Eigen values, problems of the perturbation equations (Navier-Stokes) of the fourth order. *Subject Headings:* **1. Turbulence theory 2. Origin of turbulence.**—*M.R.*

4A–23 551.511:551.551

Tollmien, Walter, **Der Burgerssche Phasenraum und einige Fragen der Turbulenzstatistik.** [The Burgers phase space and some questions on turbulence statistics.] *Zeitschrift für angewandte Mathematik und Mechanik*, 13(5):331–347, Oct. **1933.** refs., 66 eqs. English abstract in: *Physics*, 4:289–290, Aug. **1933. DLC**—The problems presented to investigators of statistical theory of turbulence due to the three rather than two dimensional nature of the motions, and due to the influence of a boundary or of walls (as in a wind tunnel) are discussed and an attempt made to extend the theories of VON KÁRMÁN and BURGERS (*see* 4A–12 above) to remove some of these difficulties on the basis of the Liouville theorem. The solutions are presented in great detail and the limitations still existing acknowledged. *Subject Heading:* **1. Statistical theory of turbulence.**—*M.R.*

1934

4A–24 551.551:532.54

Townend, H. C. H., **Statistical measurements of turbulence in the flow of air through a pipe.** *Royal Society of London, Proceedings, Ser. A*, 145(854):180–211, June **1934.** 17 figs., 6 tables, 9 refs. **DLC**—By means of shadow photographs of hot air bubbles produced by electric sparks in turbulent wakes, or by using a modification of this method known as the "Schlieren method," the distribution

of turbulence across a square pipe was determined at various distances downstream, and the various components correlated. Deviations from the mean speed of flow at any point near the center of the pipe were shown to be nearly equal in all three directions, leading to the concept of isotropic turbulence being statistically valid for wind tunnel studies. Relation between mean and maximum values were also determined statistically. *Subject Headings:* **1. Turbulence measurement 2. Isotropic turbulence 3. Wind tunnel experiments.**—*M.R.*

4A–25 532.5:551.551

Trubridge, G. F. P., **Burgers's theory of turbulence.** *Physical Society of London, Reports on Progress in Physics*, 1:43–62, **1934.** 25 refs., 82 eqs. **DLC**—A detailed mathematical account of BURGERS' attempt to apply the methods of statistical mechanics to the theory of the completely turbulent motion of a fluid between two parallel walls. Author points out that "the restriction of the motion to two dimensions is bound to make the numerical results grossly inaccurate" and suggests further testing to see if statistical methods are actually applicable to the problem. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent flow.**—*M.P.K.*

4A–26 551.511:551.551

von Kármán, Theodor, **Turbulence and skin friction.** *Journal of the Aeronautical Sciences*, N. Y., 1:1–20, **1934.** 16 figs., 3 tables, 24 refs., 55 eqs. **DWB**—Theories of skin friction investigated and consideration given to skin friction and momentum, laminar skin friction and turbulent skin friction. The mechanism of turbulent flow is examined. Experiments discussed, along with transition between laminar and turbulent region. Main problems for future research outlined. *Subject Headings:* **1. Turbulence theory 2. Boundary layer.**—*H.P.K.*

4A–27 551.511:551.508.54

Ziegler, M., **The construction of a hot wire anemometer with linear scale and negligible lag.** (*K.*) *Akademie van Wetenschappen te Amsterdam, Verhandelingen, Afdeeling Natuurkunde, Eerste Sectie*, 15(1), **1934.** 22 p. 12 figs., refs., 30 eqs. **DLC**—The theory, construction, wiring and use of the hot wire anemometer is treated in detail, with many illustrations of electrical circuits. Calibration and experiments to show sensitivity and methods of correcting for errors and lag are thoroughly discussed and illustrated. It is thought that this instrument is responsive enough for instantaneous measurements of slight wind variations. The history of the development of hot wire anemometers is included briefly. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*M.R.*

1935

4A–28 551.551:532.5(02)

Gebelein, Hans, **Turbulenz; physikalische Statistik und Hydrodynamik.** [Turbulence; physical statistics and hydrodynamics.] Berlin, Springer, **1935.** 177 p. 40 figs., numerous refs. **DWB**—One of the first comprehensive treatises on turbulence from a statistical standpoint. The text begins with a chapter on the concept of groups and probability, then goes on with the classical theory of mechanics and physical statistics, application of this theory to the study of flow, the kinetic theory of gases and Navier-Stokes theory of compressible flow, theory of turbulence tensors and statistical hydrodynamic, "Wandturbulenz," boundary theory, critical Reynolds number, and lastly some special problems of turbulent flow (in convergent and divergent channels, free turbulence and examples of calculations). *Subject Headings:* **1. Hydrodynamics 2. Statistical theory of turbulence 3. Textbooks.**—*M.R.*

4A–29 551.511:551.508

Schubauer, G. B., **A turbulence indicator utilizing the diffusion of heat.** *U. S. NACA, Annual Report*, 21:337–341, **1935.** 5 figs., table, 5 refs., eqs. **DLC**—The effect of turbulence (introduced by a series of geometrically similar screens placed one at a time across the upstream section of the tunnel) upon the diffusion of heat from a small electrically heated wire in an air stream was investigated. Curves of temperature distribution were obtained and a single relation found to exist between the width of the wake at half maximum and distance in screen wire diameters from the several screens. *Subject Headings:* **1. Laboratory turbulence models 2. Turbulence measurement.**—*From author's abstract.*

4A–30 551.511

Taylor, Geoffrey Ingram, **Statistical theory of turbulence.** *Royal Society of London, Proceedings, Ser. A*, 151(873):421–478, Sept. 2, **1935.** 14 figs., 10 tables, 12 refs., 103 eqs. **DLC**—One of the monumental works on turbulence theory, extending the author's idea that the scale of turbulence could be determined quantitatively by correlating velocities at two different times or at two different points, with motion defined in the Lagrangian manner. The present paper shows how this statistical

theory can be applied either to Lagrangian (l_1) or Eulerian (l_2) systems of flow. By using grids in wind tunnels the size of eddies can be controlled, and the length (l_1 corresponding to Prandtl's mixing length or l_2 which corresponds to average size of the eddy) determined. In Part II the results of hot wire anemometer measurements in England and America are analyzed and the predictions regarding l_2 verified, and the law of decay of isotropic turbulence formulated. Tests in pipes are further analyzed in parts III and IV. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay 3. Wind tunnel experiments.**—*M.R.*

1936

4A–31 551.511

Bakhmetev, Boris Aleksandrovich (*Columbia University*), **The mechanics of turbulent flow; lectures delivered under the William Pierson Field Foundation at Princeton University, Feb. 1935.** Princeton, Princeton University Press, **1936.** 101 p. 62 figs., refs., 136 eqs. **DWB**—A concise, well annotated and illustrated text on turbulence. The fundamental principles of laminar and turbulent motion of fluids, the Reynolds number, friction in laminar and resistance in turbulent flow, and the effect of rough surfaces are discussed in the first part. Next, the mechanics of turbulent flow, Prandtl's equation and boundary layer concept and the distribution of mixing length and velocities are treated. Thirdly, the VON KÁRMÁN theory of the nature of turbulent flow, the logarithmic law of speeds, the relation between maximum and mean velocity are presented. Finally, flow in tubes and tunnels is analyzed and the laws formulated for such flow. *Subject Headings:* **1. Turbulence theory 2. Turbulent flow 3. Textbooks.**—*M.R.*

4A–32 551.511

*Schlichting, H., **Experimentelle Untersuchungen zum Rauhigkeitsproblem.** [Experimental research on the problem of roughness.] *Ingenieur-Archiv*, Berlin, 7(1):1–34, **1936.** 21 figs., 6 tables, 20 refs., 22 eqs. Translated by S. Reiss, *U. S. NACA, Technical Memorandum*, No. 823, April **1937. DWB**—Elaborate equipment, similar to that used by Nikuradse (1932) was constructed to obtain precise measurements of the effect of many sizes and shapes of rough surfaces, and sand, on the velocity distribution and other derived parameters, for turbulent flow in pipes or tunnels. The "roughness parameters," resistance coefficients, etc. are presented in detail in graphs and tables, and discussed theoretically. It was found that for nearly every kind of rough surface or wind speed, etc. the resistance coefficient was independent of the Reynolds number. *Subject Headings:* **1. Turbulence measurement 2. Roughness parameters. I. Reiss, S.** (*trans.*).—*M.R.*

1937

4A–33 551.511

Dryden, Hugh L., **Recent developments of the theory of turbulence.** *Journal of Applied Mechanics*, New York, 4(3):A-105-A-108, Sept. **1937.** fig., 3 eqs., bibliog. p. A-108. **DLC**—The development of the statistical theory of turbulence prior to 1935 is outlined briefly, highlighting ROUSSINESQ's concept of eddy viscosity (1887), REYNOLDS' eddy stresses (1895), PRANDTL's mixing length and momentum transport (1925), TAYLOR's vorticity transport (1915, 1932) and VON KÁRMÁN's similarity theory (1930). Developments along the lines of G. I. TAYLOR's concept of isotropic turbulence, correlation measurements of scale of turbulence, decay of turbulence due to microturbulence, etc. are discussed in greater detail. *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence 3. Turbulence decay.**—*M.R.*

4A–34 551.511

Dryden, Hugh L., **The theory of isotropic turbulence.** *Journal of the Aeronautical Sciences*, N. Y., 4(7):273–280, May **1937.** 2 figs., 4 refs., 20 eqs. **DLC**—Experiments performed at the National Bureau of Standards show the variation of intensity and scale of turbulence behind $\frac{1}{4}$-inch and 5-inch mesh screens. Theoretical curves with $m=3(n=3)$ for the $\frac{1}{4}$-inch screen, and $m=7$ $(n=4)$ for the 5-inch screen, agree with experimental values plotted on diagrams. Oscillograph records of velocity fluctuations 9 feet behind a 1-inch mesh screen are also shown. Theory of intensity and scale of isotropic turbulence is reviewed and developed after TAYLOR (1935) and VON KÁRMÁN. Dissipation shown to be due not to viscosity alone, but also to stresses proportional to square of the velocity. *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence.** —*M.R.*

4A–35 551.551:533.607

Dryden, Hugh L., Schubauer, G. B., Mock, W. C. and Skramstad, H. K., **Measurements of intensity and scale of wind-tunnel turbulence and their relation to the critical Reynolds number of spheres.** *U. S. NACA, Annual Report*, 23:109–140, **1937.** 30 figs., 10 tables, 17 refs., eqs. **DLC**—

Conclusion is that critical Reynolds number of spheres depends on scale of turbulence as well as intensity.

$$R_{crit} = f\left(\frac{\sqrt{\overline{u^2}}}{u}\left[\frac{D}{L}\right]^{\frac{1}{3}}\right)$$

Wind tunnel investigations of turbulence conducted by Bureau of Standards and NACA were extended to include new variable: scale of turbulence. By varying distance between two hot wires the correlations between speed fluctuations at the two wires were determined. The variations in correlation with distance from screens, wires, or spheres, the intensity and rate of decay, the theory of decay, the effect of wire length in hot wire measurements and other factors are carefully determined and discussed, with numerous graphs illustrating findings. *Subject Headings:* **1. Statistical theory of turbulence 2. Hot wire anemometers 3. Turbulence scale 4. Wind tunnel experiments.**—*M.R.*

4A–36 551.511:551.551

Hahnemann, H., **Neue experimentelle Untersuchungen über die Entstehung der turbulenten Rohrströmung.** [New experimental research on the origin of the turbulent flow in pipes.] *Forschung auf dem Gebiet des Ingenieurwesens*, Berlin, 8:226–237, **1937.** 12 figs., 3 tables, 16 refs. **DLC**—History of research on critical limits of laminar and turbulent flow, methodology, instrumentation, statistical frequency of eddies with varying parameters, larger eddies, critical limits of perturbations, etc. Data on limits carefully tabulated and presented in graphic form. Article is an extension of the work of NAUMANN (1931 and 1935) and KURZWEG (1933). *Subject Headings:* **1. Turbulence statistics 2. Origin of turbulence.**—*M.R.*

4A–37 551.511:551.551

Pekeris, Chaim L., **The balance of vorticity in parallel shear motion.** *Journal of the Aeronautical Sciences*, N. Y., 4(6):258–259, **1937.** eqs. Abstracted from reprint. **DWB**—An extension of theory advanced by VON KÁRMÁN in 1937 which proved that the Reynolds energy integral for turbulent motion can be particularized to give a relation for the balancing of the energy of turbulent motion and derived a formula for the local balancing of vorticity to determine a relation for the balancing of vorticity over the entire space. Generation of turbulent vorticity at the boundaries is emphasized. *Subject Headings:* **1. Vorticity theory 2. Turbulence theory.**—*M.R.*

4A–38 551.511:551.551

Taylor, Geoffrey Ingram, **The statistical theory of isotropic turbulence.** *Journal of the Aeronautical Sciences*, N. Y., 4(8):311–315, June **1937.** 4 figs., 4 refs., 15 eqs. **DLC**—VON KÁRMÁN (1937) extended the author's (1935) theory of statistical turbulence to show correlations between components of velocity at 2 points and the relation between two correlation functions R_1 and R_2. In this paper, data obtained by SIMMONS at Teddington, England (National Physical Laboratory) are used to test VON KÁRMÁN's predictions for cases where the dissipation of energy is known, and the verification shown to be complete. If the shape of the correlation curve did not change with time, then the disagreement would be marked between predicted and observed curves for R_1 and in other respects. *Subject Headings:* **1. Statistical theory of turbulence 2. Wind tunnel experiments 3. Isotropic turbulence.**—*M.R.*

4A–39 532.55:551.551

*Taylor, G. I. and Green, A. E., **Mechanism of the production of small eddies from large ones.** *Royal Society of London, Proceedings, Ser. A*, 158(895):499–521, **1937.** 5 figs., 5 tables, refs., 50 eqs., append. **DWB**—The basic theory of dissipation of energy in turbulent flow is outlined. The balance of the paper consists of a mathematical attempt to trace the subsequent motion of a viscous incompressible fluid when the initial motion has a definite scale and exhibits some of the properties of statistically uniform isotropic turbulence. *Subject Headings:* **1. Turbulence theory 2. Turbulence decay 3. Isotropic turbulence.**—*M.P.K.*

4A–40 551.511:551.551

von Kármán, Theodor, **Turbulence.** *Royal Aeronautical Society, Journal*, 41(324):1108–1143, Dec. **1937.** 21 figs. **DLC**—A clear exposition of the latest ideas on turbulence, beginning with a definition of turbulence and a brief historical sketch, then taking up the mechanism of diffusion from a statistical point of view, with various special cases such as turbulence behind a discontinuity or with different gradients. The effects of skin friction (applications to aeronautical engineering), the birth and decay of turbulence, velocity fluctuation as a function of height and time, correlations and lastly applications in hydraulics are discussed. The many clever schematic diagrams help greatly in understanding the difficult concepts presented here. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion.**—*M.R.*

1938

4A–41 532.5:551.551(02)

Goldstein, Sydney (*ed.*), **Modern developments in fluid mechanics.** 2 v. Oxford, Clarendon Press, **1938. DLC**—In Vol. I, Chap. V deals with theory of turbulence from the earliest concepts to date. Paragraph 89 discusses atmospheric turbulence and other paragraphs deal with decay of isotropic turbulence, the Reynolds number, diffusion in a turbulent field, etc. In Vol. II, turbulent flow in pipes and channels, drag, lift, boundary layer problems and wakes take up several chapters. Heat transfer for laminar and turbulent flow are treated in detail. Equations of eddy transfer, the mixing length theory, Reynolds analogy between heat transfer and skin friction, etc., are considered from aeronautical engineers point of view. Much theory and many diagrams are included. *Subject Headings:* **1. Turbulence theory 2. Textbooks 3. Fluid mechanics.**—*M.R.*

4A–42 532.5:551.511

Goldstein, Sydney, **On the velocity and temperature distributions in the turbulent wake behind a heated body of revolution.** *Cambridge Philosophical Society, Proceedings*, 34(Pt. 1):48–67, **1938.** 5 figs., 104 eqs. **DLC**—Calculations based on momentum transfer theory (after PRANDTL) and the vorticity transfer theory (TAYLOR) for wakes behind a body of revolution (cylinder) show that the agreement for the Prandtl theory for various types of turbulence is not good. The theoretical velocity distributions are shown graphically for each case as compared with experimental values. A modified vorticity transfer theory is also tested but found to be no better than the momentum transfer theory. The temperature distribution was also tested according to the above theories, with results not very close to reality. *Subject Headings:* **1. Turbulence theory 2. Turbulent wakes 3. Turbulent transfer of momentum 4. Turbulent transfer of vorticity.**—*M.R.*

4A–43 532.5:551.511

Hall, A. A. and Hislop, G. S., **Velocity and temperature distributions in the turbulent wake behind a heated body of revolution.** *Cambridge Philosophical Society, Proceedings*, 34(Pt. 3):345–350, **1938.** 7 figs., **DLC**—Continuation of studies discussed in paper by GOLDSTEIN (*see* 4A–42 above), from calculations made by MISS SWAIN based on momentum transfer theory, and those based on vorticity transfer. This paper shows graphically the experimental distributions of velocity and temperature in the wake behind a heated cylinder in a low turbulence wind tunnel. Observations are reduced to mean values in order to show more symmetrical results. Method of reduction is described. *Subject Headings:* **1. Turbulent wakes 2. Wind tunnel experiments.**—*M.R.*

4A–44 551.551:533.607

Motzfeld, H., **Frequenzanalyse turbulenter Schwankungen.** [Frequency analysis of turbulent oscillations.] *Zeitschrift für angewandte Mathematik und Mechanik*, 18(6):362–365, Dec. **1938.** 3 figs., 15 eqs. **DLC**—Further theoretical development of experimental determinations of spectrum of turbulence behind screens in wind tunnels as reported by SIMMONS and SALTER (*see* 4A–47 below) curves are also presented, based on experiments performed with a special apparatus devised by the author for frequency analysis of oscillations. *Subject Headings:* **1. Turbulence spectrum 2. Statistical theory of turbulence 3. Wind tunnel experiments.**—*M.R.*

4A–45 551.511:551.551

Reichardt, Hans, **Messungen turbulenter Schwankungen.** [Measurements of turbulent oscillations.] *Die Naturwissenschaften*, Berlin, 26(24/25):404–408, June 17, **1938.** 3 figs., refs., 4 eqs. **DLC**—Technical discussion of basic principles of statistical turbulence. Beautiful illustrations of 3 types of turbulent motion as revealed by oscilloscope traces. Variations from mean values emphasized. Theoretical evaluation of electrodynamometric measurements treated. *Subject Headings:* **1. Turbulence measurement 2. Turbulence statistics.**—*M.R.*

4A–46 551.511:551.508.54

Reichardt, Hans, **Über das Messen turbulenter Längs- und Querschwankungen.** [On the recording of turbulent longitudinal and transverse fluctuations.] *Zeitschrift für angewandte Mathematik und Mechanik*, 18(6):358–361, Dec. **1938.** 3 figs., 15 eqs. Translation by Mary L. Mahler, *U. S. NACA, Technical Memorandum*, No. 1313, Aug. **1951. DLC**—Previous tests of damping of turbulence have been based on assumption of isotropic turbulence. In fact, however, turbulence is often nonisotropic, so for turbulence exchange measurements, a means has been devised for measuring fluctuations in three directions. A three direction arrangement of hot wires is described, tested and an example given of its use. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*M.R.*

4A–47 551.511:551.551

*Simmons, L. F. G. and Salter, C., **An experimental determination of the spectrum of turbulence.** *Royal Society of London, Proceedings, Ser. A*, 165(920):73–89, **1938.** 9 figs., 2 tables, refs., eqs., append. **DWB**—The time variation of velocity at a fixed point in a turbulent air stream (where the turbulence created by a grid of regular mesh was known to be isotropic) is analyzed into a spectrum. The ordinary hot-wire technique was used to produce changes of potential in a Wheatstone bridge circuit which were magnified by a valve amplifier. *Subject Headings:* **1. Turbulence spectrum 2. Turbulence measurement.**—*M.P.K.*

4A–48 551.551

Taylor, Geoffrey Ingram, **The spectrum of turbulence.** *Royal Society of London, Proceedings, Ser. A*, 164 (919):476–490, Feb. **1938.** 8 figs., 2 tables, 4 refs., 22 eqs. **DLC**—The connection between the spectrum of turbulence measured at a fixed point, and the correlation between simultaneous values of velocity measured at two points is discussed, the theory developed, and a comparison made with observations of SIMMONS and DRYDEN in wind tunnel experiments. Good agreement was found with DRYDEN's measurements made in America. The bearing of spectrum measurements on the theory of dissipation of turbulence is briefly discussed. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence spectrum.**—*M.R.*

4A–49 551.511:551.551

von Kármán, Theodor and Howarth, Leslie, **On the statistical theory of isotropic turbulence.** *Royal Society of London, Proceedings, Ser. A*, 164(917):192–215, Jan. **1938.** 3 figs., 7 refs., 84 eqs. **DLC**—Following TAYLOR (1935) the authors develop the general kinematic theory of isotropic turbulence, and introduce the use of the correlation tensor to solve the problem of correlation coefficients between derivatives of the velocities. The expression of mean values by integrals and triple correlations is formulated and the correlation between pressure and velocity considered. In the second part the dynamics of isotropic turbulence is treated attempting to solve the changes of mean values with time and presenting equations for dissipation of energy and vorticity. Finally, there is presented a possible solution for large Reynolds numbers [extending work of TAYLOR (1937)]. *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence.**—*M.R.*

1939

4A–50 551.551:551.511(02)

Brunt, David, **Physical and dynamical meteorology.** Cambridge, Eng., University Press, **1939.** 422 p. 119 figs., 10 tables, numerous refs. and eqs. **DLC**—Chapters XI and XII take up in great detail the general aspects of turbulence (Reynolds stresses, the Reynolds number, distribution of eddy energy, the nature of eddies, Bénard cells, convection, stability of motion), and atmospheric turbulence [eddy and molecular diffusion heat transfer, Richardson's "eddy conductivity" and Taylor's applications to atmospheric diffusion, diurnal variations of temperature and wind, eddy transfer of momentum (TAYLOR, SCHMIDT and PRANDTL), comparison of momentum and vorticity transport theories, austausch, Prandtl's "Mischungsweg," boundary layers, internal friction and skin friction and recent work of SUTTON, ROSSBY, MONTGOMERY and others on evaporation, wind profiles, isobaric movements and other theoretical aspects of practical importance to meteorology]. *Subject Headings:* **1. Turbulence theory 2. Textbooks.**—*M.R.*

4A–51 551.511:551.551

Jacobs, W., **Umformung eines turbulenten Geschwindigkeitsprofiles.** [Transformation of a turbulent velocity profile.] *Zeitschrift für angewandte Mathematik und Mechanik*, 19(2):87–100, April **1939.** 13 figs., 9 refs., 18 eqs. Translation by J. Vanier, *U. S. NACA Technical Memorandum*, No. 951, Sept. **1940.** **DLC**—(This is the second part of a thesis entitled "Studien zum Rauhigkeitsproblem," under Prandtl. The first part is entitled "Strömung hinter einem einzelnen Rauhigkeitselement." *Ingenieur Archiv*, Berlin, 9(5), 1938, 343 p.) Study of variations in turbulent velocity profile in flow from rough to smooth walls and vice versa. Expressions obtained for the shear stress distribution with respect to the distance from the point of junction and from the wall are used. Calculations are compared with empirical data, with fairly good agreement. *Subject Headings:* **1. Turbulence theory 2. Wind tunnel experiments 3. Velocity profiles. I. Vanier, J.** (*trans.*).—*M.R.*

4A–52 551.551:551.511(02)

†Lettau, Heinz, **Atmosphärische Turbulenz.** [Atmospheric turbulence.] Leipzig, Akademische Verlagsgesellschaft, **1939.** 283 p. 59 figs., 25 tables, 246 refs., numerous eqs. **DLC, DWB**—This classic text comprises the most thorough and systematic treatment of turbulence ever attempted. It includes chapters on turbulence in general; the history of research on hydrodynamics and (since

904) on turbulence; kinetic theory of gas movement; austausch and turbulence near the earth's urface; austausch and turbulence in atmospheric boundary layers; friction and energy dissipation in tmospheric currents; measurement of parameters connected with turbulence; large scale (planetary) urbulence, and finally, 11 pages of bibliography. (*Same item as* 11–101, Nov. 1950, *MAB.*) *Subject leadings:* **1. Turbulence theory 2. Atmospheric turbulence 3. Fluid mechanics 4. Textbooks.**—*M.R.*

4A–53 532.55:551.551

Millionshchikov, M., **Decay of homogeneous isotropic turbulence in a viscous incompressible luid.** *Akademiia Nauk, SSSR, Comptes Rendus*, 22(5):231–235, **1939.** fig., 4 refs., 13 eqs. **Decay f turbulence in wind tunnels.** *Ibid.*, p. 236–237. 3 figs., 2 refs., eq. **DLC**—The author theoetically derives $5\alpha = -5/4$ for the exponent in the exponential law of turbulence decay previously ound by VON KÁRMÁN and HOWARTH and gives explicit analytical expressions for the coefficients of orrelation between excitations at two points at any moment. In the second paper it is shown that he theoretical curves agree with results of experiments made by DRYDEN and others (*see* 4A–35 bove). *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay 3. Turbulence tatistics.**—*A.A.*

4A–54 532.5:551.511

von Kármán, Theodor, **The analogy between fluid friction and heat transfer.** *American ociety of Mechanical Engineers, Transactions*, 61(8):705–710, Nov. **1939.** 5 figs., 8 refs., 42 eqs. **DLC**—The paper deals with the problem of heat transfer in cases when the Prandtl number is different rom 1. For gases Reynolds' analogy can be applied directly in the first approximation; for fluids his is impossible since Prandtl's number is much greater than 1. The author proposes a new theoetical formula which fits the experimental results more satisfactorily than the theories of TAYLOR nd PRANDTL. The distribution of velocity and exchange coefficient in the transition layer between aminar layer and fully turbulent region is discussed. *Subject Headings:* **1. Turbulence theory . Boundary layer 3. Turbulent transfer of heat.**—*A.A.*

1940

4A–55 551.511

Reichardt, H., **Die Wärmeübertragung in turbulenten Reibungsschichten.** [Heat transfer in urbulent friction layers.] *Zeitschrift für angewandte Mathematik und Mechanik*, 20(6):297–328, Dec. **1940.** 13 figs., 83 eqs., refs. Translation in: *U. S. NACA Technical Memorandum*, No. 1047, ept. **1943. DLC**—Author reviews previous contributions to the field. Then, from the equation efining the general Prandtl number, he derives a formula which describes temperature as a function f velocity. The ratio of the turbulent shear stress to the total stress in the layers near the wall ust be known. The ratio of the exchange coefficient for heat to the exchange coefficient for momenum transfer is assumed as independent on the distance from the wall. A formula for the rate of heat ransfer is also given, similar to that offered by PRANDTL. *Subject Headings:* **1. Turbulence theory . Turbulent transfer of heat. I. Boelter, L. M. K.** (*trans.*).—*A.A.*

4A–56 551.511:551.551

Robertson, H. P., **Invariant theory of isotropic turbulence.** *Cambridge Philosophical Society, roceedings*, 36(2):209–223, April **1940.** 3 figs., 5 refs., eqs. **DLC**—This "reformulation of the kineatical part of the problem of isotropic turbulence" calls to mind "the relevant theorems of the heory of invariants and applies them to a direct determination of the form of the correlation tensors et in the theory of isotropic turbulence." *Subject Headings:* **1. Statistical theory of turbulence . Isotropic turbulence.**—*M.P.K.*

1941

4A–57 551.511:551.551

Dryden, Hugh L. (*National Bureau of Standards*), **Isotropic turbulence in theory and experient.** (In: **Theodore von Kármán Anniversary Volume.** Pasadena, California Institute of Techology, **1941.** p. 85–102. 4 figs., table, 4 refs., 41 eqs.) **DWB**—A review of the present statistical heory of isotropic turbulence suggesting a slight extension based on VON KÁRMÁN's similarity oncept. Discrepancies in the experimental results are discussed and tentatively explained. *Subject eadings:* **1. Statistical theory of turbulence 2. Isotropic turbulence.**—*From author's abstract.*

4A–58 551.511:551.551(02)

Haurwitz, Bernhard, **Dynamic meteorology.** New York, McGraw-Hill, **1941.** Chap. X, **tmospheric turbulence.** p. 188–215. 4 figs., refs., 9 eqs. Chap. XI, **Turbulent mass exchange,** 216–237. 4 figs., refs., 5 eqs. **DLC**—In Chap. X there is a lucid presentation of the basic theory

of turbulence, starting with shearing stress in viscous fluids, the Reynolds stresses and number *Re* turbulent motion, Prandtl's theory of momentum transfer, vertical wind profile, Taylor's theory of vorticity transfer, etc. and, finally, taking up work by VON KÁRMÁN, ROSSBY, SUTTON, RICHARDSON and others, and the work of HESSELBERG, SVERDRUP, ÅKERBLOM and EKMAN on the effect of turbulence on the frictional layer. Chap. XI takes up the history, theory and applications of theory of turbulent mass exchange. (*Same item* as 3K–55, Nov. 1952, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Dynamic meteorology 3. Textbooks.**—*M.R.*

4A–59 532.55:551.551

Kolmogorov, A. N., **On degeneration of isotropic turbulence in an incompressible viscous liquid.** *Akademiia Nauk, SSSR, Comptes Rendus*, 31(6):538–540, **1941.** 6 refs., 32 eqs. **DA**—In a short communication the author discusses the basic equations of the statistical theory of turbulence, shows the relationship between the Reynolds' number, the scale of turbulence and the mean turbulent velocity, derives the law of turbulence decay and finds $p=5/6$ in VON KÁRMÁN's relationship $U=U_0(t-t_0)^{-p}$, where U is mean turbulent velocity; t is time; index $_0$ is initial moment. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay.**—*A.A.*

4A–60 551.511

Kolmogorov, A. N., **The local structure of turbulence in incompressible viscous fluid for very large Reynolds' numbers.** *Akademiia Nauk, SSSR, Comptes Rendus*, 30(4):301–305, **1941.** 4 refs., 25 eqs. **DA**—The author gives definitions for "locally" homogeneous and "locally" isotropic turbulence (in distinction from the "isotropic turbulence" introduced by TAYLOR), discusses the consequences of the assumption of local isotropy and introduces basic hypothesis of similarity. *Subject Heading:* **1. Statistical theory of turbulence.**—*A.A.*

4A–61 551.511:551.551

Schmidt, Wilhelm, **Turbulente Ausbreitung eines Stromes erhitzter Luft. I. Teil.** [Turbulent propagation of a stream of heated air. Part I.] *Zeitschrift für angewandte Mathematik und Mechanik*, 21(5):265–278, Oct. **1941. Part II.** *Ibid.*, 21(6):351–363, Dec. **1941.** 13 figs., 8 tables, 9 refs., 50 eqs. **DLC**—PRANDTL's mixing length concept, which gives good experimental results, is applied to the theoretical calculation of the propagation of a plane and a three-dimensional mass of hot air. The two-dimensional transfer is calculated according to Taylor's formula. Temperature and pressure distributions are calculated for points at various distances from center of flow. The second part of this work deals with the propagation of a three-dimensional parcel. Tables and diagrams are included for facilitating calculation. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of heat. I. Prandtl, Ludwig.**—*M.R.*

1943

4A–62 551.511:551.508.54

Dätwyler, G., **Eine Apparatur zur Messung turbulenter Schwankungen in Strömungen.** [An apparatus for measuring turbulent oscillations in currents.] *Zürich. Eidgenössische Technische Hochschule, Institut für Aerodynamik, Mitteilungen*, No. 8:34–43, **1943.** 11 figs., refs., eqs. **DWB**—A well illustrated account of the adaptation of the hot wire anemometer to the measurement of velocity fluctuations in turbulent flow. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*M.P.K.*

4A–63 551.551

Dryden, Hugh L. (*National Bureau of Standards*), **A review of the statistical theory of turbulence.** *Quarterly of Applied Mathematics*, 1(1):7–42, April **1943.** 11 figs., refs., numerous eqs. **DWB**—An extensive coverage of the fundamentals of statistical theories of turbulence including explanation and discussion of turbulent fluctuations, vortex trails, the Reynolds stresses, correlation, scale of turbulence, isotropic and nonisotropic turbulence, decay of turbulence, Taylor's correlation tensor function, turbulence spectrum, turbulent diffusion, etc. *Subject Heading:* **1. Statistical theory of turbulence.**—*M.P.K.*

4A–64 551.551:551.508.54

Kovásznay, Leslie S. G., **Hitelesítési és mérési renszer a hödrótos turbulencia kutatásban.** [Calibration and measurements in turbulent research.] Budapest, Müegyetem, Aerodinamikai Intézet, **1943.** Unchecked. Translation by S. Reiss in: *U. S. NACA, Technical Memorandum*, No. 1130, **1947.** 36 p. 20 figs., 2 tables, 12 refs., 24 eqs. **DLC**—A quick review of the contributions of the chief authors in the field of hot wire anemometry and of the basic requirements which a measurement system for turbulent velocity fluctuations must satisfy. A new and reliable hot-wire turbulence measuring apparatus is described and amply illustrated with diagrams of the measuring

rcuit. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers. I. Reiss, S.** *rans.).—M.P.K.*

4A–65 551.551

Synge, J. L. and Lin, C. C., **On a statistical model of isotropic turbulence.** *Royal Society of anada, Transactions*, Sec. III:45–79, **1943.** 7 figs., 11 refs., 18 eqs., append. **DLC**—A statistical heory of homogeneous isotropic turbulence is developed by regarding the turbulent fluctuations due to Hill's vortices moving about chaotically. The calculated velocity correlation tensor of the econd order satisfies the general relations of VON KÁRMÁN, and the shape of the correlation function in general agreement with experimental results. *Subject Headings:* **1. Statistical theory of tur-ulence 2. Isotropic turbulence.**—*Author's abstract.*

1944

4A–66 551.551:551.508.54

Biedenkopf, W., **Hitzdrahtgeräte für Turbulenzmessung.** [Hot wire apparatus for turbulence easurement.] *Verein der Deutschen Ingenieure, Zeitschrift*, 88(37/38):523–525, Sept. **1944.** 8 gs., refs., eqs. **DLC**—The application of the hot wire anemometer to turbulence measurement is xplained and illustrated diagrammatically. *Subject Headings:* **1. Turbulence measurement 2. Hot ire anemometers.**—*M.P.K.*

4A–67 551.511:551.551

Ertel, Hans, **Statistische Theorie des vertikalen Turbulenz-Wärmestroms.** [Statistical theory vertical turbulent heat currents.] *Meteorologische Zeitschrift*, 61(1):14–18, Jan. **1944.** 6 refs., 5 eqs. **DWB**—Theoretical development referring to WILHELM SCHMIDT's theory of turbulent eat currents. *Subject Heading:* **1. Statistical theory of turbulence.**—*H.P.K.*

4A–68 551.551:532.5

Wieghardt, K. and Tillimann, W., **Zur turbulenten Reibungsschicht bei Druckanstieg.** [On e turbulent friction layer during rising pressure.] *Zentrale für wissenschaftliches Berichtswesen über uftfahrtforschung (ZWB), Untersuchungen und Mitteilungen*, No. 6617, Nov. 20, **1944.** 46 p. raphs. Translation in: *U. S. NACA Technical Memorandum*, No. 1314, Oct. **1951. DWB**—leasurements in turbulent friction layer along a flat plate when the static pressure from the leading dge systematically rises or decreases. Many curves included. *Subject Headings:* **1. Boundary yer 2. Wind tunnel measurements.**—*M.R.*

1945

4A–69 551.551:532.5

Bjørgum, Oddvar, **Turbulence from a novel point of view. An examination of the physical asis of hydrodynamics.** *Bergens Museum, Årbok 1944, Naturvitenskapelig rekke*, No. 3, **1945.** 1 p. 7 refs., eqs. **DLC**—A detailed development of a kinetic theory of turbulence, assuming an eal gas and "large particles" which can be treated as collections of molecules. Hence, the equations an be derived from the kinetic theory of gases without going through the intermediate step of onsidering the "small particles." The laminar flow equations are then applied to turbulent flow, if the turbulent effects were due entirely to molecular agitation. *Subject Headings:* **1. Turbulence eory 2. Hydrodynamics.**—*M.R.*

4A–70 551.511:551.551

Chou, P. Y., **On velocity correlations and the solutions of the equations of turbulent fluctuation.** *uarterly of Applied Mathematics*, Providence, R. I., 3(1):38–54, April **1945.** 14 refs., 8 eqs. **DLC**—comprehensive treatment of double and triple correlations in studying turbulent wakes and jets, nd the relation of conditions in the center of the fluid to those at the boundary. The paper was ritten in China before the author came to Pasadena in 1943. He states that triple correlations are high as one need go for studying theory of turbulence. *Subject Headings:* **1. Statistical theory of rbulence 2. Turbulence correlation functions.**—*M.R.*

4A–71 551.511:532.5(02)

Lamb, Horace, **Hydrodynamics.** 6th ed. New York, Dover Publications, **1945.** 738 p. umerous figs., refs., eqs. **DLC**—The first edition of LAMB's classical text appeared in 1879, and as entitled "A Treatise on the mathematical theory of the motion of fluids." Recent develop-ents which have been stimulated by aeronautical research have extended the earlier theory, pecially in regard to turbulent flow. Chap. VII treats on vortex motion, Chap. XI on viscosity, cluding many pertinent sections such as those on the coefficient of eddy viscosity, atmospheric rbulence, wind profile, statistical theory of turbulence, VON KÁRMÁN's formula for resistance, the

boundary layer, compressibility, etc. Many other applications of hydrodynamics to meteorology will be found in this profound work. Well-indexed by author and subject, and supplied with numerous references to sources. *Subject Headings:* **1. Turbulence theory 2. Textbooks 3. Atmospheric turbulence 4. Hydrodynamics.**—*M.R.*

1946

4A–72 551.511:551.55

Corrsin, Stanley and Uberoi, Mahinder S., **Further experiments on the flow and heat transfer in a heated turbulent air jet.** *U. S. NACA, Technical Note,* No. 1865, April **1946.** 61 p. 27 figs. 24 refs., 26 eqs. **DLC**—Measurements were made of the mean total heat and temperature fields in a round turbulent jet with various initial temperatures. Results show that jet spreads more rapidly as its density becomes lower than that of the surrounding medium, even with slight or unmeasurable differences. Amount of spread is worked out quantitatively and numerous graphs and diagrams are presented to show rates of transfer of heat and momentum. *Subject Headings:* **1. Turbulence measurement 2. Turbulent transfer of heat 3. Turbulent transfer of momentum.**—*M.R.*

4A–73 551.511:551.55

†Cumming, Betty L., **A review of turbulence theories.** *Australia. Council for Aeronautics Report,* No. ACA-27, Aug. **1946.** 22 p. 54 refs. **DWB**—Equations solved for turbulence in non-uniform and uniform streams. Continuous statistical theory, isotropic turbulence, mixing lengths, decay of intensity and scale of turbulence, spectrum of turbulence, and dissipation of energy and vorticity, use of statistical mechanics, SYNGE and LIN's theory of isotropic turbulence, orographic effects and screen effects are reviewed. *Subject Heading:* **1. Turbulence theory.**—*M.R.*

4A–74 551.508.53/4:551.55

Rabot, Maurice, **Un anemomètre à fil chaud pour les mesures de turbulence en soufflerie** [A hot wire anemometer for measurement of turbulence in wind tunnels.] *Groupement Français pour le Développement des Recherches Aéronautiques, Rapport Technique,* No. 64, **1946.** 52 p. 15 figs., 5 tables, 8 refs., 39 eqs. **DLC**—A comprehensive report, with elaborate diagrams, of progress made in development of a sensitive hot wire anemometer. Work was done at the Aerodynamic Research Center at Toulouse. Changes in speed from 2 to 2000 times a sec. can be recorded with winds up to 50 m/sec. Very useful in turbulence investigations. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*M.R.*

4A–75 551.551:551.508.5

Schubauer, G. B. and Klebanoff, P. S., **Theory and application of hot-wire instruments in the investigation of turbulent boundary layers.** *U. S. NACA. Wartime Report,* No. W-86, March **1946.** 44 p. 22 figs., table, 13 refs., 43 eqs. **DLC**—Several types of hot wire anemometers are described, theory given and tests conducted to determine characteristics and errors in turbulent velocity measurements. Results presented graphically. *Subject Headings:* **1. Hot wire anemometers 2. Turbulence measurement.**—*M.R.*

1947

4A–76 551.511:551.55

Batchelor, G. K. and Townsend, A. A., **Decay of vorticity in isotropic turbulence.** *Royal Society of London, Proceedings, Ser. A,* 190(1023):534–550, Sept. 9, **1947.** 11 figs., 7 refs. Review by J. M. Robertson in: *Applied Mechanics Reviews,* 1(2):53, Feb. **1948. DWB**—The consequences of isotropy are discussed and the vorticity equation developed. Wind tunnel experiments at the Cavendish Laboratory, using a hot wire anemometer, a statistical analyzer and triple correlator (circuit diagrams shown) are described, and diagrams presented showing the decay of intensity of turbulence, the variation of λ, $R\lambda$, S and G during decay, and the variations of S with mesh Reynolds number and of G with $R\lambda$. S, G and $R\lambda$ are shown to be approximately constant during decay, and the vorticity balance is the same at all stages of decay, giving support to the theory of dynamical similarity of KOLMOGOROV (1941) and the author. *Subject Headings:* **1. Statistical theory of turbulence 2. Wind tunnel experiments 3. Isotropic turbulence 4. Turbulence decay. I. Robertson, J. M.**—*M.R.*

4A–77 551.511:551.55

Chou, P. Y., **The turbulent flow along a semi-infinite plate.** *Quarterly of Applied Mathematics* 5(3):346–353, Oct. **1947.** fig., 6 refs., 5 eqs. **DLC**—Analysis shows that the shearing stress is constant across the turbulent boundary layer at high Reynolds number. The importance of the triple velocity correlation within the boundary layer is stressed. Turbulence is generated in this layer and transported away from it and the triple velocity correlation is a measure of this transport. Double correlation only gives the balance between production of turbulent energy by deformation

of mean flow, and the decay of turbulence. *Subject Headings:* **1. Statistical theory of turbulence 2. Shear stresses 3. Boundary layer 4. Turbulence correlation functions.**—*From author's abstract.*

4A–78 551.511

†Dryden, Hugh L., **Some recent contributions to the study of transition and turbulent boundary layers.** *U. S. NACA Technical Note*, No. 1168, April **1947.** 44 p. 23 figs., bibliog. p. 24–32. **DLC**—A review of status of boundary layer theory in 1938, and advances since 1938, especially the methods of Buri, Gruschwitz, Fediaevsky and Kalikhman. An investigation at the National Bureau of Standards to determine the fluctuations in a turbulent boundary layer under adverse pressure gradients sufficient to produce separation, is described. Excellent bibliography included. *Subject Headings:* **1. Boundary layer 2. Bibliographies.**—*M.R.*

4A–79 551.511:551.551

Ertel, Hans and Rombakis, S., **Zur Theorie des virtuellen Reibungskoeffizienten.** [On the theory of the virtual friction coefficient.] *Zeitschrift für Meteorologie*, 1(15):459–461, Dec. **1947.** 7 refs., 25 eqs. Review by Leslie S. G. Kovásznay in: *Applied Mechanics Reviews*, 2(2):39, Feb. **1949. DWB**—"This treatment of turbulent transport of momentum, turbulent friction and dissipation is not essentially different from the old phenomenological theories of turbulence because the fluctuation intensity is assumed to be proportional to the gradients of mean motion." The authors express this proportionality in such a way that "turbulent viscosity becomes α^2 times the molecular viscosity." *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of momentum. I. Kovásznay, Leslie, S. G.**—*M.P.K.*

4A–80 551.511

Koo, Chen-chao, **Pressure flow of a turbulent fluid in channels.** *Meteorological Magazine*, Nanking, 19(1–4):63–69, Aug. **1947.** 2 figs., 2 tables, 6 refs., 5 eqs. In Chinese, English summary p. 63. **MH-BH**—The distribution of velocities in a wind channel is calculated from Montgomery's assumption for mixing length. The calculated distribution agrees with observations. (*Same item as* 2.4–68, April 1951, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Mixing length.**—*C.E.P.B.*

4A–81 551.551:551.508.54

Liepmann, H. W. and Laufer, J., **Investigations of free turbulent mixing.** *U. S. NACA Technical Note*, No. 1257, Aug. **1947.** 61 p. 37 figs., eqs., 21 refs. **DLC**—Although this investigation is made more for technical purposes, the meteorologist too will be interested in the methods of observation. Measurements of the mean velocity, the intensity and scale of the turbulent fluctuations and of the turbulent shear in a two-dimensional mixing zone are presented. A detailed theoretical discussion is given. Very useful is an appendix dealing with the method of corrections for the difference in sensitivity of two hot wires used for correlation-coefficient measurements. Instructive photographs of correlation figures are given. *Subject Headings:* **1. Turbulence measurement 2. Statistical theory of turbulence 3. Turbulent diffusion 4. Hot wire anemometers.**—*A.A.*

4A–82 551.511:551.551

Moretti, G., **La teoria del trasporto turbolento.** [The theory of turbulent transport.] *Aerotecnica*, Rome, 27(1):44–50, Feb. **1947.** 13 refs., 17 eqs. Review by J. Kampé de Fériet in: *Applied Mechanics Reviews*, 1(2):53, Feb. **1948. DWB**—In this paper the author presents a short critical review of the well-known "turbulent transport" theories of Prandtl, Taylor, and Mattioli. He concludes that it is better to avoid any hypothesis referring to some kind of turbulent transport and assumes simply that the Reynolds' stress might be expressed in terms of U, the velocity of mean motion. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of momentum 3. Turbulent transfer of vorticity. I. Kampé de Fériet, J.**—*J. Kampé de Fériet.*

4A–83 551.511:551.551

Tetervin, Neal, **Boundary layer momentum equations for three dimensional flow.** *U. S. NACA Technical Note*, No. 1479, Oct. **1947.** 27 p. 5 figs., 8 refs., 17 eqs. **DLC**—Derivations are given in extenso for three-dimensional boundary layer momentum equations for a fluid with variable density and viscosity (similar to those of Prandtl, 1946), and the two-dimensional derivations first given by von Kármán compared. Kehl's equations (1943) for a flow in a converging or diverging channel are also given (for a fluid with constant density and viscosity). *Subject Headings:* **1. Boundary layer 2. Turbulent flow.**—*M.R.*

4A–84 551.511:551.551:001

†Tetervin, Neal, **A review of boundary-layer literature.** *U. S. NACA Technical Note*, No. 1384, July **1947.** 36 p. 7 figs., 48 refs., eqs. **DLC**—The symbols, terminology and methods of calculation for laminar and turbulent boundary layers are given and the mathematical derivations of Prandtl's

boundary layer, von Kármán's momentum equations and Pohlhausen's expression for the velocity profile are appended. An excellent bibliography of material in all languages on boundary layer theory is also included. *Subject Headings:* **1. Bibliographies 2. Boundary layer 3. Terminology.**—*M.R.*

1948

4A–85 551.551

Bass, Jean, **The foundations of a statistical theory of turbulence.** *Seventh International Congress of Applied Mechanics, Proceedings*, 2(Pt. 1):212–226, **1948.** Original unchecked. Review by A. A. Townsend in: *Applied Mechanics Reviews*, 3(10):315, Oct. **1950. DLC**—Author considers statistical theory of turbulence using concepts of mathematical theory of random functions, and in these terms is able to define very generally, distribution, correlation and spectrum functions for turbulent field. Functional equation of turbulence and its connection with the Navier-Stokes equations are considered. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence correlation functions. I. Townsend, A. A.**—*A. A. Townsend.*

4A–86 551.551

Batchelor, G. K., **Energy decay and self-preserving correlation functions in isotropic turbulence.** *Quarterly of Applied Mathematics*, Providence, R. I., 6:97–116, July **1948.** 2 figs., 14 refs., 6 eqs. **DLC**—Author considers properties of turbulence in fluid of zero mean motion which can be deduced from assumption of spatial homogeneity and isotropy. Loitsianskiĭ's invariant, self-preserving solutions at small Reynolds numbers, solutions obtained by neglecting the triple correlation, partially self-preserving solutions at small Reynolds number and at high Reynolds number (self-preserving and non self-preserving) are developed in detail. The various hypotheses named above and the deductions therefrom, are summarized in a table for small and large Reynolds number. *Subject Headings:* **1. Turbulence decay 2. Turbulence correlation functions 3. Statistical theory of turbulence.**—*M.R.*

4A–87 551.551:551.511

Batchelor, G. K. and Townsend, A. A., **Decay of isotropic turbulence in the initial period.** *Royal Society of London, Proceedings, Ser. A*, 193(1035):539–558, July 21, **1948.** 12 figs., 2 tables, 9 refs. Review by J. M. Robertson in: *Applied Mechanics Reviews*, 1(9):247, Sept. **1948. DWB**—Continuation of earlier work by same authors (*see item* 4A–76 above) and experimental verification of some recent theoretical investigations. Results of measurements of turbulent intensity; significance of "initial period of decay"; development of law for decay; experimental confirmation that the decay law changes in the expected direction when the time is large. Suggested division of life history of turbulence into initial, transition and final periods; within the initial period a classification based on the Reynolds number is possible. Some speculations on the interpretation of the initial period are presented. (*Same item as* 1–91, Jan. 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay. I. Robertson, J. M.**—*From authors' abstract.*

4A–88 551.551

Batchelor, G. K. and Townsend, A. A., **Decay of turbulence in the final period.** *Royal Society of London, Proceedings, Ser. A*, 194(1039):527–543, Nov. 9, **1948.** 5 figs., refs. Review by A. M. Kuethe in: *Applied Mechanics Reviews*, 2(2):39, Feb. **1949. DWB**—Results of experiments carried out in the Cavendish Laboratory, by aid of wind tunnel and hot wire anemometer. Review of previous discussion of isotropic turbulence at small Reynolds numbers; consideration of local or unaveraged turbulent velocities, with deduction of asymptotic decay law and other results; double velocity correlations in the final period of decay; measurements of turbulence in the final period; nature and conditions for existence of final period decay. Thorough mathematical and graphical presentation. (*Same item as* 1–92, Jan. 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Wind tunnel experiments 3. Turbulence correlation functions 4. Turbulence decay. I. Kuethe, A. M.**—*M.R.*

4A–89 551.551

Burgers, J. M. (*Tech. Univ. Delft, Holland*), **A mathematical model illustrating the theory of turbulence.** *Advances in Applied Mechanics*, New York, 1:171–199, **1948.** 60+eqs. **DLC**—A system of mathematical equations, much simpler than those of hydrodynamics, is given. The basic differential equations consider the mean motion, exterior forces, frictional effect and the secondary motion. For the second motion a Fourier series can be used. These basic equations give solutions for the laminar case, for the turbulence spectrum (steady and unsteady cases) and can be applied to an infinite domain and to similarity considerations. A system is also given for two components in the secondary motion. The properties of the turbulent solutions in this case are discussed. *Subject Heading:* **1. Turbulence theory.**—*A.A.*

4A–90 551.511:551.551

Casal, Pierre, **Dissipation de l'énergie en turbulence homogène.** [Energy dissipation in homogeneous turbulence.] *Académie des Sciences, Paris, Comptes Rendus*, 226(1):57–59, Jan. 5, **1948.** 6 eqs. Review by J. V. Wehausen in: *Applied Mechanics Reviews*, 1(5):148–419, May **1948. DWB**—The author shows theoretically that "the probable value of dissipation of energy per unit volume and during a unit of time is proportional to the probable value of the square of the modulus of the turbulent vector." *Subject Headings:* **1. Turbulence decay. I. Wehausen, J. V.**—*M.R.*

4A–91 551.511:551.551

Djang, G. F., **A kinetic theory of turbulence.** *Chinese Journal of Physics*, 7:176–191, June **1948.** Unchecked. Review by Hugh L. Dryden in: *Applied Mechanics Reviews*, 1(10):270, Oct. **1948. DLC**—This paper is based on an analogy between the theory of turbulence and the kinetic theory of gases. The author believes that the square of the Reynolds number of the turbulence $(u'\lambda_m/\nu)^2$ is analogous to the temperature of a gas, which he regards as a dimensionless quantity. It is assumed that turbulence flows from a region of high to regions of low Reynolds' numbers. The Boussinesq eddy viscosity concept is used, but it is assumed that the eddy viscosity equals $k\lambda_m{}^2u'/\nu$ rather than $k_1\rho\lambda_m u'$, as is more common. *Subject Headings:* **1. Statistical theory of turbulence. I. Dryden, Hugh L.**—*H. L. Dryden.*

4A–92 551.511:551.551

†Dryden, Hugh L., **Recent advances in the mechanics of boundary-layer flow.** *Advances in Applied Mechanics*, New York, 1:1–40, **1948.** Review by A. W. Wundheiler in: *Applied Mechanics Reviews*, 1(10):269, Oct. **1948. DLC**—The following topics are covered in this highly informative review (the numbers in parentheses indicate the numbers of papers listed in the bibliography at the end of each section): laminar flow in boundary layers (45 papers), stability of laminar boundary-layer flow (23 papers), boundary-layer suction (15 papers), turbulent flow in boundary layers (13 papers). An additional bibliography on drag calculations (10 papers) and flight tests on boundary layers (4 papers) completes this article. *Subject Headings:* **1. Boundary layer 2. Turbulent flow. I. Wundheiler, A. W.**—*A. W. Wundheiler.*

4A–93 551.511:551.551

Frenkiel, François N., **Comparison between theoretical and experimental results on the decay of turbulence.** *Seventh International Congress for Applied Mechanics, Proceedings*, 2:112–126, **1948.** 5 figs., 14 refs., 40 eqs. Abstracted from reprint. **DWB**—Author refers to the theorem of Loitsianskiĭ on the conservation of the disturbance moment during the decay of homogeneous and isotropic turbulence and derives the equations of decay without arbitrary constants for small and large Reynolds numbers. Although experimental results show good agreement, the author emphasizes that the basic assumption should be verified by careful experiments. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay.**—*A.A.*

4A–94 551.511:551.551

Frenkiel, François N., **The decay of isotropic turbulence.** *Journal of Applied Mechanics*, 15:311–321, Dec. **1948.** 13 figs., 19 refs., 28 eqs., append. **DWB.** Review by Hugh L. Dryden in: *Applied Mechanics Reviews*, 2(2):38, Feb. **1949. DLC**—An equation of decay of isotropic turbulence at large and small Reynolds numbers is derived using the von Kármán-Howarth equations and applying Loitsianskiĭ's theorem of conservation of disturbance moment. Experimental measurements behind grids show good agreement with the equations for large Reynolds numbers. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay. I. Dryden, Hugh L.**—*From author's abstract.*

4A–95 551.551

Frenkiel, François N., **On the kinematics of turbulence.** *Journal of the Aeronautical Sciences*, 15(1):57–64, Jan. **1948.** 9 figs., 13 refs., 16 eqs. Review by Hugh L. Dryden in: *Applied Mechanics Reviews*, 1(3):79, March **1948. DWB**—Study of statistical theory with respect to correlation coefficients and turbulence spectra, based on experimental data. Isotropic and nonisotropic turbulence considered. *Subject Heading:* **1. Statistical theory of turbulence.**—*M.R.*

4A–96 551.511:551.551

Frenkiel, François N., **On third-order correlation and vorticity in isotropic turbulence.** *Quarterly of Applied Mathematics*, 6:86–90, April **1948.** 4 refs., 25 eqs. **DLC**—It was found that the decay of vorticity is proportional to $(\bar{w}^2)^{24/17}$ and not to $(\bar{w}^2)^{3/2}$ as Batchelor and Townsend proposed. G is considered constant, but $N\lambda$ and S variable. Other disagreements with Batchelor's and Townsend's results are cited, but these may be due to experimental inaccuracies, such as imperfect

isotropy behind grids and errors due to finite length of hot wires. *Subject Headings:* **1. Turbulence decay 2. Statistical theory of turbulence.**—*From author's abstract.*

4A–97 551.511:551.551

Heisenberg, W., **On the theory of statistical and isotropical turbulence.** *Royal Society of London, Proceedings, Ser. A*, 195(1042):402–406, Dec. 22, **1948.** Review by H. B. Squire in: *Applied Mechanics Reviews*, 2(6):137–138, June **1949. DWB**—Application of statistical theory of problem of decay of turbulent motion on small scale eddies. Continuation of work started by TAYLOR, VON KÁRMÁN and HOWARTH and expanded by KOLMOGOROV, ONSAGER and WEIZSÄCKER in their similar hypotheses to determine spectrum for eddies with large Reynolds numbers. (*Same item as* 1–95, Jan. 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence.**—*M.R.*

4A–98 551.551

Heisenberg, W., **Zur statistischen Theorie der Turbulenz.** [On the statistical theory of turbulence.] *Zeitschrift für Physik*, 124:628–657, **1948. DLC.** Review by C. C. Lin in: *Applied Mechanics Reviews*, 3(9):277, Sept. **1950. DWB**—Author develops the statistical theory of isotropic turbulence from the point of view of spectrum analysis, noting the relation between the spectra obtained from a one-dimensional Fourier analysis and from a three-dimensional analysis. An assumption is introduced regarding the transfer mechanism, leading to a definite law of spectrum for the range of frequencies chiefly responsible for dissipation, using an interpolation formula. The mean pressure fluctuation and the velocity correlation function are calculated, and the constant of proportionality appearing in the transfer function is estimated. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence spectrum. I. Lin, C. C.**—*M.R.*

4A–99 551.511

Hinze, J. O. and van der Hegge Zijnen, B. G., **Transfer of heat and matter in the turbulent mixing zone of an axially symmetric jet.** *Seventh International Congress of Applied Mechanics, Proceedings*, 2(Pt. 1):286–299, **1948.** Unchecked. Review by Stanley Corrsin in: *Applied Mechanics Reviews*, 3(9):278, Sept. **1950. DLC**—This paper is a report of some very careful measurements of mean velocity, temperature, and concentration in round, fully developed turbulent jets at low subsonic speeds, with an essentially constant density system. *Subject Headings:* **1. Turbulence measurement 2. Turbulent transfer of heat. I. Corrsin, Stanley.**—*S. Corrsin.*

4A–100 551.511

Hopf, Eberhard, **A mathematical example displaying features of turbulence.** *Communications on Applied Mathematics*, N. Y., 1(4):303–322, Dec. **1948.** eqs. **DLC**—The author, dissatisfied with semi-empirical pictures of turbulent fluid motion such as the mixing length or similar "intuitive" concepts, tries to get some results using the Navier-Stokes differential equations and Fourier series. He discusses the behavior of the solutions as the time $t \to +\infty$. *Subject Heading:* **1. Turbulence theory.**—*A.A.*

4A–101 551.511:551.551

IAglom, A. M., **Odnorodnaia i izotropnaia trubulentnost' v viazkoĭ szhimaemoĭ zhidkosti.** [Homogeneous and isotropic turbulence in viscous compressible fluids.] *Akademiia Nauk, SSSR, Ser. Geogr. i Geofiz.*, 12(6):501–522, **1948.** 18 refs. **DLC**—Applying the spectral theory of random turbulence proposed by KOLMOGOROV to the statistical work on turbulence of FRIEDMAN and KELLER as developed by VON KÁRMÁN and HOWARTH, the author assuming that the 3rd moment is negligible compared to the second, presents a solution, by means of 48 complicated equations and Fourier series, for the case of uniform isotropic turbulence in viscous compressible and incompressible fluids. *Subject Heading:* **1. Statistical theory of turbulence.**—*M.R.*

4A–102 551.511

Kovásznay, Leslie S. G., **Spectrum of locally isotropic turbulence.** *Journal of the Aeronautical Sciences*, 15(12):745–753, Dec. **1948.** 14 figs., 4 tables, 15 refs., 78 eqs. **DLC**—For large eddies the agreements and discrepancies are the same as for Kolmogorov's theory. For the viscous region the present theory gives explicit expressions with only one empirical numerical constant R_0, for the spectrum and correlation functions. The agreement with experiments is satisfactory but could be greatly improved. *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence 3. Turbulence spectrum.**—*M.R.*

4A–103 551.551

Ledinegg, M., **Der Mechanismus der Turbulenz.** [The mechanism of turbulence.] *Österreichisches Ingenieur-Archiv*, Vienna, 2(3):244–260, March **1948. DLC**—A basic theoretical in-

vestigation. The forces acting on an eddy (idealized as a solid cylinder) in a current with velocities ncreasing with distance from the wall are examined. Eddy transport and decay are discussed. The result, applied to the velocity distribution in a tube, is the logarithmical law for the velocity distribution near the wall. For the center of the tube a theoretical law is developed, similar to the one found previously experimentally by DARCY. *Subject Heading:* **1. Turbulence theory.**—*A.A.*

4A–104 551.511:532.5

Nigam, S. D., **On development of turbulent liquid motion over an infinite plate.** *Philosophical Magazine*, 7th. Ser., London, 39(298):867–873, Nov. **1948.** 2 figs., 4 refs., 23 eqs. **DLC**—An attempt to solve the problem taking full account of the viscous sub-layer adjacent to the plate, where the flow is laminar and the eddy-viscosity zero. Next to this layer both turbulence and viscosity become effective. At a very great distance from the plate the viscous-turbulent flow merges asymptotically into the constant flow. The calculation is based on the vorticity transfer theory of TAYLOR, a proposal of TAKAHASI and PRANDTL's assumption for the eddy kinematic viscosity of the fluid. The author gives solutions for the velocity component inside and outside the laminar sub-layer and for the thickness of the viscous sub-layer. *Subject Headings:* **1. Turbulence theory 2. Hydrodynamics.**—*A.A.*

4A–105 551.511:551.551

Schmitz, Hans Peter, **Zur Theorie der Austauschströme.** [On the theory of turbulent exchange.] *Zeitschrift für Meteorologie*, 2(3):71–77, March **1948.** fig., 7 refs., 69 eqs. **DLC**—A theoretical development using a new definition of the equivalent displacement whereby the number of independent components in Ertel's theory (1937) is reduced from 6 to 4, allowing derivation of general equation for turbulent exchange in terms of either volume or mass transport. Variations in density are neglected as being insignificant with respect to velocity variations. *Subject Headings:* **1. Turbulent exchange 2. Turbulence theory.**—*M.R.*

4A–106 551.511:551.551

†Sutton, O. G., **Atmospheric turbulence.** London, Methuen, [**1949**]. 107 p. 4 figs., 2 tables, refs. **DLC**—A small book which contains the essence of the series of lectures given by SUTTON in Washington in November 1948. Highly theoretical but based on years of "field testing" of theory. Chapters entitled: I. Turbulence, II. Meteorology of lower atmosphere, III. Early theories and applications to large-scale phenomena, IV. Mixing length and statistical theories of turbulence, V. Diffusion near the ground, VI. Turbulence in a variable density gradient. (*Same item as* 4–92, April 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Atmospheric turbulence 3. Turbulent diffusion.**—*M.R.*

4A–107 551.551

Townsend, A. A., **Experimental evidence for the theory of local isotropy.** *Cambridge Philosophical Society, Proceedings*, 44:560–565, Oct. **1948.** 4 figs., 4 refs., eqs. **DLC**—Experiments performed at high Reynolds numbers behind a biplane grid show results in good agreement with predictions made according to Kolmogorov's theory of local isotropy. The skewness factor of the frequency distribution of velocity differences is nearly constant (−0.38). The flattening factor is also nearly constant (3.49) showing that there is a systematic distinction from the normal Gaussian distribution. *Subject Headings:* **1. Turbulence statistics 2. Kolmogorov's theory.**—*A.A.*

4A–108 551.511:551.551

von Kármán, Theodor, **Progress in the statistical theory of turbulence.** *National Academy of Sciences, Washington, D. C., Proceedings*, 34(11):530–539, Nov. **1948.** 3 figs., 3 refs., 19 eqs. **DLC**—A brief review of the fundamental contributions of REYNOLDS (statistical mean values), PRANDTL (momentum transfer) and TAYLOR (vorticity transfer) followed by the author's contribution in application of the similarity principles which led to the discovery of the logarithmic law of velocity distribution in shear motion for homologous turbulence. Then TAYLOR's definition of isotropic turbulence, the analysis through correlation and spectral functions by the author and HOWARTH, and further advances by HEISENBERG, ONSAGER, KOLMOGOROV and WEIZSÄCKER and finally, applications through wind tunnel tests by the author and others are reviewed and amplified. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence correlation functions.**—*M.R.*

4A–109 551.511:551.551

von Weizsäcker, C. F., **Das Spectrum der Turbulenz bei grossen Reynoldsschen Zahlen.** [The turbulence spectrum at large Reynolds' numbers.] *Zeitschrift für Physik*, 124:614–627, **1948.** Unchecked. Review by C. C. Lin in: *Applied Mechanics Reviews*, 3(8):246, Aug. **1950. DLC**—The author considers a volume filled with isotropic turbulence of linear dimension L_0, subdivided into successively smaller volumes of linear dimensions L_n, and discusses the mean value of the physical

quantities over these volumes. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence spectrum. I. Lin, C. C.**—*C. C. Lin.*

1949

4A–110 551.551:551.51

Batchelor, G. K., **The role of big eddies in homogeneous turbulence.** *Royal Society of London Proceedings, Ser. A*, 195(1043):513–532, Feb. 3, **1949. DWB.** Review by A. M. Kuethe in: *Applied Mechanics Reviews*, 3(2):54, Feb. **1950. DLC**—Continuation of work of HEISENBERG on decay of isotropic turbulence to show that small eddies play the role of viscosity in dissipating energy of big eddies. (*Same item as* No. 1–93, Jan. 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay. I. Kuethe, A. M.**—*M.R.*

4A–111 551.511:551.55

Batchelor, G. K. and Townsend, A. A., **The nature of turbulent motion at large wave-numbers.** *Royal Society of London, Proceedings, Ser. A*, 199(1057):238–255, Oct. 25, **1949.** 7 figs., 15 refs., eqs. **DWB.** Review by S. Chandrasekhar in: *Applied Mechanics Reviews*, 4(1):50, Jan. **1951 DLC**—Measurements were made in a small wind tunnel in the Cavendish Laboratory, using the same hot wire anemometer used by the authors in their 1947 studies (*see* 4A–76 above), except for a turbulence amplifier with a low-pass filter (described and illustrated). Measurements were mostly with isotropic turbulence and an attempt was made to describe the distribution of turbulent energy over Fourier components of large wave numbers. It was found that there are fluctuations of the turbulence spectrum at large wave numbers, which can be explained by an instability being produced early in the turbulence in the nature of a transfer of energy from small vortices to a number of strong discrete vortices. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence measurement 3. Turbulence spectrum. I. Chandrasekhar, S.**—*M.R.*

4A–112 551.551:551.508.54

Betchov, R., [**Nonlinear theory of the hot wire anemometer.**] (*K.*) *Akademie van Wetenschappen te Amsterdam, Proceedings*, 52:195–207, March **1949.** Unchecked. Review by Wilhelm Spannhake in: *Applied Mechanics Reviews*, 2(9):210, Sept. **1949. DWB**—The author assumes the transfer of heat from the hot wire to the air to depend partly on the difference of temperature and partly on the square of that difference expanding in this way the linear law of King. The differential equations, based upon this assumption and describing the change of the wire resistance with time and length of the wire, is solved for both the steady and unsteady state. The total resistance of the wire is then obtained by integration. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers. I. Spannhake, W.**—*W. Spannhake.*

4A–113 551.511:551.55

Chandrasekhar, S., **On the decay of isotropic turbulence.** *Physical Review*, 75(9):1454–1455, May 1, **1949.** fig., refs. Review by C. C. Lin in: *Applied Mechanics Reviews*, 3(7):214, July **1950 DWB**—Letter to editor discussing HEISENBERG's recent paper (*see* 4A–97 above) and commenting that whenever the Reynolds number is finite there is always a minimum size to the eddies during the process of decay, and this minimum size grows with the time like $(t)^{\frac{1}{2}}$. But when the Reynolds number becomes infinite this minimum size tends to zero. (*Same item as* 1–94, Jan. 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Turbulence decay. I. Lin, C. C.**—*M.R.*

4A–114 551.551:551.508.54

†Corrsin, Stanley, **Extended applications of the hot-wire anemometer.** *U. S. NACA, Technical Note*, No. 1864, April **1949.** 62 p. 4 figs., 32 refs., 46 eqs. **DLC**—Two new applications of hot wire anemometry are proposed. The conventional response equations and methods of measuring mean velocity and temperature and fluctuations thereof, and for measuring mean velocity and concentration in an isothermal flowing mixture of two gases, and for the same with velocity and concentration fluctuations, are developed. *Subject Headings:* **1. Hot wire anemometers 2. Bibliographies.**—*M.R.*

4A–115 551.551:551.508.54

Frenkiel, François N., **The influence of the length of a hot wire on the measurements of turbulence.** *Physical Review*, 75(8):1263–1264, April 15, **1949.** refs., eqs. **DLC**—The influence of the length (l) is discussed for cases when l/λ is small (λ = microscale of turbulence), when l/L_y is large (L_y = transverse scale of turbulence) and for intermediate cases. If I_b is the correction factor for the measured intensity of longitudinal turbulence, then $(1/I_b^{-2}) = 1 - l^2/6\lambda^2$ for small values of l/λ. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*A.A.*

4A–116 551.551:551.511

Hardtwig, E., **Über den Aufbau der allgemeinen Turbulenz- und Austauschtheorie und die Formulierung des Austauschproblems.** [On the construction of the general theory of turbulence and austausch theory and the formulation of the austausch problem.] *Zeitschrift für Meteorologie*, 3(1–3):26–32, 72–77, Jan.–March **1949.** 13 refs., 93 eqs. **MH-BH**—Author sets out to construct a mathematical theory of turbulence with the fewest possible assumptions. These include turbulence as a mechanical system, and ideas about an "element of turbulence"; transport of a property by the motion of such an element is according to the equations of transport; the velocity of the center of gravity of an element is the sum of the mean velocity and the component equations; the mass of an element is constant. He finally derives a series of difficult differential equations which cannot be solved (and if they could, he says, the results would not be worth the trouble!). The problem must be simplified by considering only variations in the vertical. (*Same item as* 3–51, April 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Turbulent exchange.**—*C.E.P.B.*

4A–117 551.511

Kolmogorov, A. N., **O droblenii kapel' v turbulentnom potoke.** [On atomization of droplets in a turbulent flow.] *Akademiia Nauk, SSSR, Doklady*, 66(5):825–828, June **1949.** 2 refs., eqs. **DLC**—Referring to the article by BARANAEV et al, in the same issue the author investigates the dispersion of sound, ultra short radio waves and light in a turbulent atmosphere and its relation to kinematic viscosity by means of theoretical and laboratory study of the dispersion by atomization of drops in a turbulent fluid. Based on theory of KOLMOGOROV and OBUKHOV (1941). *Subject Headings:* **1. Isotropic turbulence 2. Statistical theory of turbulence.**—*M.R.*

4A–118 551.508.54:551.551

Kovásznay, Leslie S. G., **Hot-wire investigation of the wake behind cylinders at low Reynolds numbers.** *Royal Society of London, Proceedings, Ser. A*, 198(1053):174–190, Aug. 15, **1949.** 13 figs., 3 tables, 8 refs. **DWB**—Detailed tables and graphs show the results of numerous measurements made at Cavendish Laboratory with a hot wire anemometer. These experiments led to conclusion that: 1) the critical Reynolds number is a well-defined value for infinitely long cylinders and the pattern that appears is unique and stable and 2) the vortices develop some distance downstream within the range of Reynolds numbers 40 to 160, and are not shed directly from the cylinder; and hence, the phenomenon may be considered as an instability in the laminar wake that develops up to an amplitude limit but dies out before becoming turbulent, at least in the low Reynolds number range. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers 3. Turbulent wakes.**—*M.R.*

4A–119 551.551

Obukhov, A. M., **Lokal'naia struktura atmosfernoĭ turbulentnosti.** [Local structure of atmospheric turbulence.] *Akademiia Nauk, SSSR, Doklady*, 67(4):643–646, **1949.** 2 figs., 9 refs., 14 eqs. **DLC**—It is claimed that the author developed the theory of locally isotropic turbulence simultaneously with KOLMOGOROV (1941). Difficulties mentioned by TOWNSEND (1948) in reconciling results of wind tunnel turbulence measurements with those in the atmosphere are discussed and an attempt made to solve these difficulties theoretically. Graphs show the spectrum of turbulence for a wind tunnel measurement and for a logarithmic boundary layer such as would be encountered in the free atmosphere. *Subject Headings:* **1. Atmospheric turbulence 2. Statistical theory of turbulence 3. Turbulence spectrum 4. Wind tunnel measurements.**—*M.R.*

4A–120 551.511:551.551

Obukhov, A. M., **Pul'satsiia davleniia v turbulentnom potoke.** [The pulsation of pressure in a turbulent flow.] *Akademiia Nauk, SSSR, Doklady*, 66(1):17–20, **1949.** 9 refs., 16 eqs. **DLC**—The theory of pressure distribution and structure of isotropic turbulence in an incompressible fluid is developed briefly. The method is also applicable for calculating the correlation of the field of pressure in a quadratic velocity field of isotropic turbulent flow. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence pressure fluctuations.**—*M.R.*

4A–121 551.551:551.511:551.524.1

Obukhov, A. M., **Struktura temperaturnogo polia v turbulentnom potoke.** [Structure of the temperature field in a turbulent current.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i. Geofiz.*, 13(1):58–69, **1949.** figs., 8 refs., 25 eqs. **DWB, DLC**—Development of KOLMOGOROV's theory with application to the problem of microvariations in temperature. Since sensitive instruments for measuring slight variations of temperature in a turbulent current are not available, use is made of statistical theory to study the degree of inhomogeneity of the temperature field with respect to free energy, to changes in time, pulsations, etc. Used not only for theoretical studies, but in atmospheric acoustics and optics. (*Same item as* 1–99, Jan. 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Atmospheric turbulence 3. Kolmogorov's theory.**—*M.R.*

4A–122 551.511:551.551

Onsager, L., **Statistical hydrodynamics.** *Il Nuovo Cimento, Supplement*, Bologna, 6(2):279–287, **1949.** Unchecked. Review by A. A. Townsend in: *Applied Mechanics Reviews*, 3(8):246, Aug. **1950. DWB**—Statistical consideration of the motion of n parallel vortexes in an incompressible frictionless fluid of finite volume shows that vortexes of the same sign tend to approach one another and form large complex vortexes if the total energy is greater than a certain value. The relevance of this idealized model to real problems is discussed; the characteristics of fully turbulent motion are reviewed; the redistribution of energy along the infinite number of possible degrees of freedom is visualized as an accelerated cascade process; the energy density in the latter stages of the process are determined; and observations of atmospheric diffusion are cited to confirm the theory. It is pointed out that theoretically dissipation of energy can occur in the absence of viscosity. *Subject Headings:* **1. Turbulence theory 2. Laboratory turbulence models 3. Eddy viscosity. I. Townsend, A. A.**—*A. A. Townsend.*

4A–123 551.511:532(02)

†Prandtl, Ludwig, **Führer durch die Strömungslehre.** [Guide to fluid dynamics.] 3rd ed. (5th ed. of original.) Brunswick, Friedr. Vieweg und Sohn, **1949.** 407 p. 347 figs., numerous refs., numerous eqs., append., classified bibliog. **MH-BH**—Subjects treated in detail include properties of fluids, boundary layers, turbulence, friction or drag, turbulent heat exchange, convective cells, Coriolis force, vortices, and the classic theories of hydrodynamics (equations of motion or continuity, BERNOULLI'S equations, vorticity, stationary motion, etc.). The 1949 edition contains many references and notes not found in the 1942 or 1944 editions, and in addition has made available the results of much research during the war, both in Germany and abroad, on convection, turbulence and boundary layer phenomena. For English translation *see item* 4A–205 below. (*Same item* as 9–54, Sept. 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Fluid mechanics 3. Mechanics of the atmosphere 4. Textbooks.**—*M.R.*

4A–124 551.551:532

Townsend, A. A., **The fully developed turbulent wake of a circular cylinder.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences*, 2(4):451–468, Dec. **1949.** 12 figs., 14 refs., 3 eqs. **MH-BH**—A detailed summary of work done by the author during the past year and based on extension of laboratory work of CHOU (1945), CORRSIN (1947), DRYDEN (1948) and the author (1947, 1948 and 1949) using the statistical theory of turbulence to supply deficiencies of Prandtl-Taylor formulations when considering turbulent transport of momentum, energy and heat in the wake of obstacles in the path of moving streams of air. It was found that the requirements of the dynamical similarity hypothesis were approximated between 500 and 950 diameters from the cylinder (8 to 16 m behind a cylinder 1.6 mm in diameter). Observed values in this area are plotted to show goodness of fit to theoretical curves of universal functions. Mean velocity distribution, energy diffusion rates, intermittency factors, dissipation length parameter, energy balance, convection of energy, jet convection and gradient diffusion values shown graphically. (*Same item as* 2.3–58, March 1951, *MAB.*) *Subject Headings:* **1. Turbulent wakes 2. Fluid mechanics.**—*M.R.*

4A–125 551.551:532.5

Townsend, A. A., **Momentum and energy diffusion in the turbulent wake of a cylinder.** *Royal Society of London, Proceedings, Ser. A*, 197(1048):124–140, May 11, **1949.** 9 figs., 16 refs., eqs. **DLC**—The energy balance in the wake of an obstacle in a wind tunnel is calculated and formulated graphically. The mechanism of the wake is discussed—especially the production of intermittent jets. *Subject Headings:* **1. Turbulence decay 2. Turbulent wakes 3. Wind tunnel experiments.**—*M.R.*

1950

4A–126 551.551

Agostini, Léon, and Bass, Jean, **Les théories de la turbulence.** [Turbulence theories.] *France, Ministère de l'Air. Publications Scientifiques et Techniques*, No. 237, **1950.** 118+p. Unchecked. Review by J. V. Wehausen in: *Applied Mechanics Review*, 4(1):50, Jan. **1951. DLC**—Book provides a unified exposition of statistical theory of turbulence as it has been developed in recent years starting with work of G. I. TAYLOR and ending about middle of 1949. Included are chapters on random functions, correlation and spectral functions, the implications of the Navier-Stokes equations, Kolmogorov's similarity theory for locally isotropic turbulence, and the problem of decay of turbulence behind a grid. Fundamental definitions and formulas are listed and a short but adequate bibliography included. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence correlation functions 3. Kolmogorov's theory 4. Turbulence decay. I. Wehausen, J. V.**—*J. V. Wehausen*

4A–127 551.511:551.551:533

Batchelor, G. K. and Stewart, R. W., **Anisotropy of the spectrum of turbulence at small wave numbers.** *Quarterly Journal of Mechanics and Applied Mathematics*, Oxford, 3(1):1–8, **1950.** 3 figs., 12 eqs. **DLC**—As a continuation of the previous work (*see item* 4A–110 above) the behavior of the large eddies formed behind a grid in a uniform air current is examined experimentally. The spectrum at small wave numbers is considered; then the velocity correlation at large values of r, in the initial and in the final period of decay. Conclusion is that the elements of the turbulence (both large and small) are anisotropic even though the total turbulent energy is distributed symmetrically in all dimensions. *Subject Headings:* **1. Turbulence measurement 2. Wind tunnel experiments 3. Anisotropic turbulence.**—*M.R.*

4A–128 551.551:551.511(09)(410)

†Calder, K. L., **Progress in the problems of atmospheric turbulence 1939–1947.** *International Union of Geodesy and Geophysics, Association of Meteorology, Oslo, 1948, Procès-verbaux*, 3:131–137, Nov. **1950.** 34 refs. In English. **DWB**—Over 30 papers on turbulence were published in the United Kingdom between 1939 and 1947. These are listed and the work of the major research workers, as evidenced by these papers, summarized. (*Same item as* 3.8–121, Aug. 1952, *MAB.*) *Subject Headings:* **1. Turbulence research 2. British Isles.**—*M.R.*

4A–129 551.511(02)

Eckert, E. R. G., **Introduction to the transfer of heat and mass.** New York, McGraw-Hill, **1950.** 284 p. 143 figs., 18 tables, refs., 297 eqs. Appendix by Robert M. Drake, Jr. **DWB**—A text for advanced students of physics or engineering based on the fundamental theories of thermal conductivity, laminar and turbulent flow and the special application of Prandtl's boundary layer theories and later adaptation by von Kármán (momentum equations); of solutions of turbulent heat exchange problems by the above and by Reynolds and G. I. Taylor; of forced convection in turbulent flow, free convection, condensation, evaporation, thermal and black body radiation; emission from solids, liquids, gases and flames; diffusion and evaporation into air are all of importance to the solution of fundamental problems of meteorology. The book, especially the appendix by Robert W. Drake, Jr., is full of useful tables, constants and nomograms for calculating problems in energy or mass exchange. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of heat 3. Textbooks. I. Drake, Robert M., Jr.**—*M.R.*

4A–130 551.508.53/4:551.551

Frenkiel, François N., **Introduction to some topics on turbulence.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics, Lecture Ser.*, No. 3, **1950.** 103 p. numerous figs., refs., eqs. Mimeographed. **DWB**—Several lectures by the author, given at the University of Maryland as an introduction to a course in statistical theory of turbulence. The theory of turbulent diffusion according to the statistical concept, which began in 1920 with G. I. Taylor's classic paper and was followed in 1935 by Taylor's second paper, is covered in lecture I. In subsequent lectures the experimental measurements, the statistical kinematics of turbulence, the Kármán-Howarth equation, hot wire anemometry, one-dimensional spectrum of turbulence, probability distribution, isotropic, and locally isotropic turbulence are treated theoretically and references listed for each lecture. (*Same item as* 3.6–120, June 1952, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Hot wire anemometers 3. Lecture series. I. Pai, S. I.** (*ed.*).—*M.R.*

4A–131 551.551:551.541

Inoue, Ei-ichi, **On the pressure fluctuations in a turbulent fluid.** *Tokyo. University. Geophysical Institute, Geophysical Notes*, 3(33), **1950.** 5 p. 9 refs., 24 eqs. Also: *Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—Fluctuation of pressure is expressed as sum of pressures of individual eddies, proportional to their kinetic energies. From this author derives the spectral function of pressure fluctuations in the form $P^2E^{4/3}K^{-7/3}$ where K is inversely proportional to wave length. *Subject Headings:* **1. Statistical theory or turbulence 2. Turbulence pressure fluctuations.**—*C.E.P.B.*

4A–132 551.551:551.524.1

Inoue, Ei-ichi, **On the temperature fluctuations in a heated turbulent fluid.** *Tokyo. University. Geophysical Institute, Geophysical Notes*, 3(34), **1950.** 5 p. 6 refs., 16 eqs. Also: *Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—Fluctuation of temperature in turbulent flow past a heated grid is expressed as sum of heat transfer by different sized eddies. Spectrum of temperature fluctuation is of the form $Q^2\epsilon^{-2/3}\kappa^{-7/3}$. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent transfer of heat 3. Fluid mechanics.**—*C.E.P.B.*

4A–133 551.511:551.551

Inoue, Ei-ichi, **Prandtl number in a turbulent fluid.** *Tokyo. University. Geophysical Institute, Geophysical Notes*, 3(35), **1950.** 5 p. 15 refs., 8 eqs. Also: *Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—Prandtl number σ is defined as ν/κ where ν and κ are molecular kinematic viscosity and molecular thermal conductivity. In air $\sigma=0.75$. Author thinks that same ratio holds for eddy diffusion of momentum and heat; experiments give ratio 0.65. In water, momentum should be more diffusible than heat. For turbulent diffusion of water vapor η he finds $\eta/\kappa=1.22$. *Subject Headings:* **1. Turbulent exchange 2. Prandtl number.**—*C.E.P.B.*

4A–134 551.551:551.511

Kampé de Fériet, J. (*Prof. Univ. of Lille*), **Atmospheric turbulence.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics, Lecture Series*, No. 7, **1950.** 40 p. diagrs., graphs, eqs. **DWB**—A lucid and slightly humorous review of the various theories of turbulent motion which contribute to the current attempts at solution of the problem of statistical turbulence or turbulent diffusion in the atmosphere. Laws of Boussinesq and Reynolds, scale of turbulence, instrumentation, Fourier analysis, microturbulence in the boundary layer of the atmosphere, temperature variation, wind profile, stability, shearing stress, fluctuations of density, experimental methods of the author and FRENKIEL, and the problem of the "random walk" are discussed with necessary equations and drawings to illustrate the factors involved. *Subject Headings:* **1. Turbulent diffusion 2. Atmospheric turbulence 3. Lecture series 4. Statistical theory of turbulence. I. Pai, S. I.** (*ed.*).—*M.R.*

4A–135 551.551:513.56

Kampé de Fériet, J., **Mathematical methods used in the statistical theory of turbulence; Harmonic analysis.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics, Lecture Series*, No. 1, **1950–1951.** 108 p. 2 figs., 8 refs., 7 eqs. E. Zarantonello, Appendix I. S. I. Pai, Appendix II. **DWB**—Details of a series of lectures on the statistical basis for turbulence theory, with special emphasis on harmonic analysis. The various chapters include the development of the integral solutions for: I. Monotonous nondecreasing functions, II. Riemann-Stieltjes integrals, III. Lebesque integrals, IV. Fourier Stieltjes integrals and Fourier transformation of a function of class L, V. Fourier fundamental theorem, VI. Inversion formula, VII. Fourier transformation of a function of class L_2 in N-dimensional space, and the two appendixes, I. Non linearity of space, S, and II. Example of Fourier transformation of an orthonormal set in a bounded domain. In Chap. VII a new expansion is derived for the Fourier transformation of a function of N variables of class L_2 equal to zero out of a bounded set, in terms of a uniformly convergent series of orthonormal functions. (*Same item as* 3.5–217, May 1952, *MAB.*) *Subject Headings:* **1. Fourier analysis 2. Statistical theory of turbulence 3. Harmonic analysis 4. Lecture series. I. Zarantonello, E. II. Pai, S. I.**—*M.R.*

4A–136 551.551

Kano, K., **On the Richardson's criterion concerning the increase or decrease of turbulent energy in the free atmosphere.** *Geophysical Magazine*, Tokyo, 21(3):220–226, March **1950.** 10 refs., 17 eqs. **MH-BH**—From the fundamental equations for wind motion the author deduces L. F. RICHARDSON's criterion for the increase or decrease of energy of turbulent flow in the atmosphere. *Subject Headings:* **1. Atmospheric turbulence 2. Richardson criterion.**—*I.L.D.*

4A–137 551.551

Lucke, O., **Bemerkungen zur Definition des Austauschtensors. I.** [Remarks on the definition of the austausch tensor. I.] *Zeitschrift für Meteorologie*, 4(7–8):216–222, July–Aug. **1950.** 2 figs., 11 refs., 34 eqs. **MH-BH**—Author defines the austausch tensor for any property of air as the mean tensor product of the turbulent velocity and the vector along which that property retains its value. This agrees with G. I. TAYLOR if the turbulent flow is built up of limited cells of laminar flow, and with ERTEL if the time interval is limited. There follows a mathematical development under certain assumptions as to nonpersistent acceleration, leading to an evaluation of the persistence innate in variations of wind velocity, and to an expression connecting the austausch tensor with the most important observed magnitudes; it is proportional to the scatter matrix of the property. (*Same item as* 2.5–109, May 1951, *MAB.*) *Subject Heading:* **1. Turbulent exchange.**—*C.E.P.B.*

4A–138 551.551

New York University. College of Engineering. Research Division, **Experimental studies of small scale turbulence.** Contract AF 19(122)-261, Progress Reports 142–01–142-06, Aug. 31, **1950**–Nov. 30, **1951.** figs., tables, refs., eqs. **DWB**—Reports represent progress made in an attempt to learn more about eddy motion and energy through direct observations of the details of turbulent motions in the atmosphere. An improved apparatus and stereographic photographic

echnique were employed in making a series of photographs of turbulent motions in a shear zone. Other aims of the project discussed in ensuing reports include the analysis by Reynolds' method of he field of turbulence; computation of eddy kinetic energy, eddy stresses, eddy transformation unction and other characteristics; a study of statistical significance; and an attempt to discover whether eddy stresses are related systematically to the mean motion. *Subject Headings:* **1. Turbulence measurement 2. Stereographic photography 3. Turbulence theory. I. Contract AF 19(122)-261.**—*M.P.K.*

4A–139 551.511

Shvets, M. E., **O priblizhennom metode resheniia nekotorykh zadach geofiziki i aerogidromekhaniki.** [Method of approximate solution of some geophysical and aerohydromechanical problems.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,* 19(81):236–254, **1950.** 2 figs., 4 tables, 8 refs., 16 eqs. **DLC**—Theoretical solution of integral equations for heat conduction, coefficient of eddy diffusion, convective motions in laminar boundary layers, etc. *Subject Headings:* **1. Turbulent exchange 2. Boundary layer.**—*M.R.*

4A–140 551.551:533.16

Sutton, O. G., **On the stability of a fluid heated from below.** *Royal Society of London, Proceedings, Ser. A,* 204:297–309, **1950.** fig., 6 tables, 13 refs., 19 eqs. **DWB**—Discusses the criterion for the onset or extinction of free convection in a layer between two horizontal planes. By Rayleigh's theory, sustained free convection is only possible if (difference of density)/(density at bottom) exceeds a critical value proportional to Rayleigh critical number/cube of depth of layer. Values of the critical number are given for free and rigid boundaries. Observations show that this is accurate for layers of depth exceeding 8 mm, where cellular convection develops at small temperature differences. In shallower layers of air (4–7½ mm) a columnar circulation develops when the ratio of absolute temperature at base to top exceeds 1.026 to 1.018. At the temperature difference given by Rayleigh's formula columnar passes into cellular convection. (*Same item as* 2.7–115, July 1951, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Convective cells.**—*C.E.P.B.*

1951

4A–141 551.551

Bass, Jean, **Les correlations d'espace et de temps en turbulence homogène.** [Correlation of space and time in homogeneous turbulence.] *Académie des Sciences, Paris, Comptes Rendus,* 232(21):1905–1906, May 21, **1951.** 6 eqs. **DWB**—The statistical theory of turbulence in an incompressible flow is briefly discussed, assuming that the turbulence is homogeneous in space and steady in time. The results can be applied to a wind tunnel only at small Reynolds numbers. The curves of equal correlation parallel the longitudinal component of the velocity. The theoretical forecast agrees very well with observations. *Subject Headings:* **1. Statistical theory of turbulence 2. Wind tunnel experiments.**—*A.A.*

4A–142 551.551:551.543:532.517.4

Batchelor, G. K., **Pressure fluctuations in isotropic turbulence.** *Cambridge Philosophical Society, Proceedings,* 47(2):359–374, April **1951.** 3 figs., table, 16 refs., 67 eqs. **DLC**—The correlation is calculated between fluctuating pressures at two points in a field of homogeneous isotropic turbulence. With very large Reynolds numbers the mean-square pressure fluctuation is $0.34\,\rho^2(\overline{u}^2)^2$. The mean-square pressure gradient is evaluated for very small and very large Reynolds numbers and an interpolation formula is devised. The relation between gradient and rate of diffusion from a fixed source is calculated and compared with observations of temperature wake from a line source of heat. (*Same item as* 3.2–121, Feb. 1952, *MAB.*) *Subject Headings:* **1. Turbulence pressure fluctuations 2. Turbulence correlation functions.**—*C.E.P.B.*

4A–143 551.511:551.543

Bjørgum, Oddvar, **On energy transformations and the effect of fluctuating pressure gradients in turbulent shear flow.** *Bergen. Universitetet. Årbok, Avhandlinger og Årsberetning, Naturvitenskapelig rekke,* No. 3, **1951.** 18 p. 2 figs., 5 tables, refs., eqs. **DWB**—In a simple case of steady shear flow, Kolmogorov's theory of local isotropy implies that, in the fully turbulent region, the average work done by the fluctuating pressure forces vanishes, i.e.,

$$\overline{u\frac{\partial p}{\partial x}}+\overline{v\frac{\partial p}{\partial y}}+\overline{w\frac{\partial p}{\partial z}}=0$$

where u, v, w denote the velocity fluctuations and p the pressure fluctuation. However, calculations based on measurements indicate that the first term is positive when the x axis is in the direction of

the mean flow, whereas the second and third terms seem to be negative. It is seen that the turbulen transport of turbulent energy plays an important part in energy consideration. *Subject Heading* **1. Turbulence theory 2. Turbulence pressure fluctuations 3. Kolmogorov's theory.**—*A.A.*

4A–144 551.51

Bjørgum, Oddvar, **On the analogy between turbulent transfer of heat and momentum.** *Bergen Universitetet. Årbok, Avhandlinger og Årsberetning, Naturvitenskapelig rekke*, No. 10, **1951.** 8 p 5 refs., 29 eqs. **DWB**—The author shows that the equations for turbulent transfer of momentum an heat are different, even if Prandtl's number is 1, because the fluctuating pressure force in turbulen shear flow strives to diminish the velocity fluctuations in the direction of mean flow. As to hea transfer or diffusion of matter no corresponding effect is present if there are no sources or sinks The only effect of homogeneization of temperature or concentration differences is then the proces of disintegration of eddies. *Subject Headings:* **1. Turbulence theory 2. Turbulent transfer of hea 3. Turbulent transfer of momentum.**—*A.A.*

4A–145 551.55

Bjørgum, Oddvar, **On the steady turbulent flow along an infinitely long smooth and plane wall** *Bergen. Universitetet. Årbok, Avhandlinger og Årsberetning, Naturvitenskapelig rekke*, No. 7, 1951 14 p. 3 figs., 3 refs., 3 eqs. **DWB**—It is shown that the logarithmic velocity profile and othe basic characteristics of turbulent flow can be derived through simple physical reasoning and dimen sional analysis without any assumption as to the nature of the exchange process. Near the boundar the following formula for the eddy viscosity is suggested: $K=\kappa^2U^2\left|\frac{dU}{\partial y}\right|^{-1}$, U—mean velocity y—axis perpendicular to the wall; κ—a new general constant with preliminary value: 0.069. Th velocity profile in the viscous layer near the boundary is then $\frac{U}{\sqrt{\sigma}}=\frac{1}{\kappa}\tanh\frac{\kappa\sqrt{\sigma}y}{\nu}$ where $\sqrt{\sigma}$—friction viscosity and ν—kinematic viscosity. *Subject Headings:* **1. Turbulence theory 2. Boundary laye 3. Eddy viscosity.**—*A.A.*

4A–146 551.511:551.55

Brier, Glenn W. (*U. S. Weather Bureau*), **The statistical theory of diffusion by turbulent eddies** *Meteorological Monographs*, Boston, 1(4):15–19, Nov. **1951.** figs., 4 refs., 43 eqs. **MH-BH**—In th statistical theory of turbulence consideration is given to the frequency distributions, correlatio coefficients, and other statistical properties of the irregular random motions and fluctuations tha occur in a turbulent fluid. The diffusion of particles is known to depend upon the Lagrangia correlation coefficient $R\xi$ defined as the correlation between the velocity of a fluid particle at an instant and that of the same particle after a time interval ξ. However, most modern turbulenc theory and practical experiments are based upon the Eulerian coordinate system in which the scal and intensity of turbulence are expressed in terms of the fluctuations at fixed points. Application o probability theory suggests that the rate of diffusion of particles can be related to the Eulerian correlations. Some of the most important unsolved problems of statistical turbulence theory ar discussed as well as the difficulties in applying the theory to diffusion in the atmosphere. *Subjec Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion.**—*Author's abstract.*

4A–147 551.55

Chuang, F. K., Cole, J. D. and Roshko, A., **On the statistical theory of turbulence.** California University. Institute of Technology, Contract NAw-5777, July **1951.** 40 p. 14 refs., eqs. Avail able at U. S. Weather Bureau Library on Microfilm SF 365. **DWB**—Part I is a discussion of th Kármán-Howarth equation and of the restricted "solutions" that have been obtained on the basi of various hypotheses. Correlation and spectrum functions are discussed. In Pt. II a linearize solution is given for the transport of the vorticity connected with the velocity fluctuations. In Pt III a solution is given to a non-linear equation which exhibits some of the characteristics of th mechanics of turbulence. *Subject Headings:* **1. Statistical theory of turbulence. I. California University. Institute of Technology II. Contract NAw-5777.**—*From authors' abstract.*

4A–148 551.51

Corrsin, Stanley, **The decay of isotropic temperature fluctuations in an isotropic turbulence** *Journal of the Aeronautical Sciences*, 18(6):417–423, June **1951.** **DWB**—Based on approach o VON KÁRMÁN and HOWARTH, an attempt is made at predicting the time rate of change of temperatur fluctuations during decay of isotropic temperature fluctuation field and the isotropic turbulence i which it occurs. It is shown that at both extremely small and large Péclet numbers the temperatur fluctuations die out at a slower rate than velocity fluctuations. *Subject Headings:* **1. Turbulenc decay 2. Isotropic turbulence.**—*M.R.*

4A–149 551.511

*Corrsin, Stanley and Uberoi, Mahinder S., **Spectra and diffusion in a round turbulent jet.** *U. S. NACA, Technical Note*, No. 2124, **1951.** 80 p. 36 figs., 28 refs., eqs. **DLC**—In a round turbulent jet at room temperature, measurement of the shear correlation coefficient as a function of frequency (through band-pass filters) has given a rather direct verification of Kolmogorov's local-isotropy hypothesis. In heated and unheated jets, one-dimensional power spectra of velocity and temperature fluctuations, and two corresponding transverse correlation functions are measured and contrasted. Mean thermal wakes behind local (line) heat sources in the unheated turbulent jet and the order of magnitude of the temperature fluctuations are determined. *Subject Headings:* **1. Turbulence spectrum 2. Statistical theory of turbulence 3. Turbulent jets 4. Kolmogorov's theory.**—*NACA abstract.*

4A–150 551.511:551.551

Dobryshman, E. M., **Ob odnom metode resheniia uravneniia turbulentnoĭ teploprovodnosti.** [On a method of solving the equation of turbulent heat transfer.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, Leningrad, 1:132–143, **1951.** fig., table, 2 refs., 44 eqs. **DLC**—Detailed mathematical analysis of the solution of the differential equation for determining the variations of temperature in the surface air layer. The method applies the classic theory of heat transport to the surface layer of the atmosphere for small time intervals. An approximate solution for greater time intervals might be possible by introducing the thickness of the boundary layer. *Subject Headings:* **1. Turbulent transfer of heat 2. Turbulence theory.**—*N.T.Z.*

4A–151 551.511

Ferrari, Carlo, **The turbulent boundary layer in a compressible fluid with positive pressure gradient.** *Journal of the Aeronautical Sciences*, 18(7):460–477, July, **1951.** 8 figs., 3 tables, 10 refs., 46 eqs. **DLC**—Application of the turbulence theory to the special problem, involving the increase in pressure in the direction of motion. The results are compared with experimental data, as far as the last are obtainable. *Subject Headings:* **1. Turbulence theory 2. Boundary layer.**

4A–152 551.551

Frenkiel, François N., **Frequency distributions of velocities in turbulent flow.** *Journal of Meteorology*, 8(5):316–320, Oct. **1951.** 5 figs., 9 refs., 21 eqs. **MH-BH**—A pressure-tube, cup or hot wire anemometer gives only the horizontal component of a turbulent wind. The relations between the frequency distributions of these and of the turbulent components parallel to the mean velocity are calculated for various ratios of fluctuations across and along wind, assuming small correlation between these (nonisotropic as well as isotropic turbulence). Two experimental frequency distributions with cup anemometers 24 and 100 ft above ground agree with the calculated distributions and are used to find the mean velocity and intensity of turbulence. (*Same item as* 3.4–166, April 1952, *MAB.*) *Subject Headings:* **1. Turbulence spectrum 2. Turbulence measurement.**—*C.E.P.B.*

4A–153 551.511

Gandin, L. S. and Solovelchik, R. E., **O skheme Prandtlia v teorii turbulentnosti.** [On Prandtl's scheme in the turbulence theory.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 23(85):49–65, **1951.** 2 figs., 56 eqs. **DLC**—The authors examine critically and didactically the hypothesis of PRANDTL's equations for turbulent movement. Using PRANDTL's approach, they examine all the dynamic problems arising in the study of turbulent flow on a plane surface and in a cylindrical tube. (*Same item as* 3.7–136, July 1952, *MAB.*) *Subject Headings:* **1. Turbulence theory. I. Prandtl, Ludwig.**—*I.L.D.*

4A–154 551.551 551.511

Goldstein, S., **On the law of decay of homogeneous isotropic turbulence and the theories of the equilibrium and similarity spectra.** *Cambridge Philosophical Society, Proceedings*, 47(3):554–574, July **1951.** 21 refs., 111 eqs. **DWB**—Since KOLMOGOROV's theory of equilibrium spectra is satisfied only at very high Reynolds numbers, an extension of this theory is proposed. This extension gives the law of decay devised by C. A. LIN. A more general law is also derived from an extension of HEISENBERG's theory of the similarity spectrum. An experiment is suggested to test some results. (*Same item as* 3.7–137, July 1952, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay.**—*A.A.*

4A–155 551.511

Imahori, K. and Hori, J., **On the diffusion by turbulent motion.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(10):327–335, Oct. **1951.** 6 figs., 29 eqs. **MH-BH**—A theoretical outline of the correlation function method, of the Fokker-Planck method, of the decay of turbulence

and of the calculations of the exchange coefficient. A few practical measurements are given. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion.**—*A.A.*

4A–156 551.551:533.6

Kampé de Fériet, J., **Averaging processes and Reynolds equations in atmospheric turbulence.** *Journal of Meteorology*, 8(5):358–361, Oct. **1951.** 20 eqs., 9 refs. **MH-BH**—Four axioms assumed by REYNOLDS in deriving his equations for turbulent flow are discussed and it is shown that they can probably be satisfied by averaging only eddies of a given diameter (imposed by the instrument used in measurement), smaller eddies remaining unknown. (*Same item as* 3.4–168, April 1952, *MAB.*) *Subject Heading:* **1. Turbulence theory.**—*C.E.P.B.*

4A–157 551.511:551.551

Kimbara, J., **On the animate growth of energy of eddy current.** *Geophysical Magazine*, Tokyo 22(4):323–333, Aug. **1951.** 6 figs., 47 eqs. English summary p. 323. **MH-BH**—DR. S. FUJIWHARA, developed in 1923 (*Jap. Journ. Astro-Geophys.*, No. 1(5), 1923) a law for the growth of the energy of eddies, assuming that the atmosphere is in neutral equilibrium and the molecular viscosity of the air is negligibly small. The author treats the same problem for a discontinuous interface using as a basis the differential equation of RICHARDSON. *Subject Heading:* **1. Turbulence theory.**—*A.A.*

4A–158 551.511:551.551

Liepmann, H. W., Laufer, J. and Liepmann, Kate, **On the spectrum of isotropic turbulence.** *U. S. NACA, Technical Note*, 2473, Nov. **1951.** 61 p. 28 figs., tables, 26 refs. **DWB**—An experimental investigation of: 1) the correlation function and spectrum at large Reynolds numbers 2) the decay, microscale and spectrum at low and intermediate Reynolds numbers, and 3) the zeros of the fluctuating velocity components and their relation to the spectrum and moments of the spectrum. At large Re the range of frequencies of spectrum is near to $n^{-5/3}$, and at small Re, $A/B - n^2$. At $x/M = 1000$ the spectrum approaches a Gaussian distribution. (*Same item as* 3.7–89, July 1952 *MAB.*) *Subject Headings:* **1. Turbulence spectrum 2. Isotropic turbulence.**—*M.R.*

4A–159 551.51

Lin, Chia-chiao and Shen, S. F., **Studies of von Kármán's similarity theory and its extension to compressible flows; a critical examination of similarity theory for incompressible flows.** *U. S. NACA, Technical Note*, No. 2541, Nov. **1951.** 24 p. 22+16 eqs., 12 refs. **DWB**—VON KÁRMÁN's similarity theory for incompressible flows is examined critically by using modern concepts in order to provide a basis for extending the theory to compressible flows. It is found that the original form of the theory is supported by modern concepts. *Subject Heading:* **1. Statistical theory of turbulence.**—*NACA abstract.*

4A–160 551.511 532.5

Munk, Max M., **On turbulent fluid motion.** *Journal of the Aeronautical Sciences*, 18(7):442–446, **July 1951.** fig., 13 eqs. **DWB**—Basic considerations of turbulent fluid motion in a straight channel are given to clarify the turbulence problem. Chiefly the Poiseuille and Couette flows are examined. A quantitative estimate is given. Turbulence is necessary for statistical equilibrium. *Subject Heading:* **1. Turbulence theory.**—*A.A.*

4A–161 551.51

Proudman, Ian, **A comparison of Heisenberg's spectrum of turbulence with experiment.** *Cambridge Philosophical Society, Proceedings*, 47(Pt. 1):158–176, Jan. **1951.** 12 figs., 2 tables, 13 refs. 4 eqs., append. **MH-BH**—An attempt to test the solutions for decay of isotropic turbulence which Heisenberg postulated on the basis of an integral equation for the energy spectrum. The theoretical double and triple velocity correlation functions f(r), g(r) and h(r) are obtained for two Reynolds numbers and the numerical results shown graphically. It is concluded that neither the distribution of energy in the theoretical spectrum at large wave numbers and the variation of the spectrum with Reynolds number is satisfactory. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay 3. Turbulence spectrum.**—*M.R.*

4A–162 551.511:551.551:532.5

Rubert, Kennedy F. and Persh, Jerome, **A procedure for calculating the development of turbulent boundary layers under the influence of adverse pressure gradients.** *U. S. NACA, Technical Note*, No. 2478, Sept. **1951.** 61 p. graphs, refs., eqs. **DWB**—A procedure based on the kinetic energy equation and an extended form of the momentum equation has been devised for calculating the development of turbulent boundary layers in adverse pressure gradients. Predictions, by this method, of turbulent-boundary-layer development in comparison with experimental results from

everal sources are presented for a number of cases of flow over flat plates and airfoils and in conical iffusers. In the range of boundary-layer flow short of separation, the agreement with experiment s, in most cases, quite satisfactory; in some instance, however, there is definite disagreement between he calculated and experimental results. It is believed, however, that good agreement has been btained in enough instances to justify continuation of effort along the present lines, particularly vith respect to improvement of the correlations and refinement of the equations. *Subject Headings:* . **Boundary layer 2. Turbulence theory.**—*Author's abstract.*

4A–163 532.56

Sackman, L. A., [**Turbulence in the state of generation.**] *France. Ministère de l'Air, Publications Scientifiques et Techniques, Actes Coll. Inter. Mécanique* III, No. 251:221–229, **1951.** Original nchecked. Review by R. L. Pigford in: *Applied Mechanics Reviews*, 5(10):436, Oct. **1952. DLC**—Measurements of the fluctuating velocity of flow were made in the transition region using a straight, orizontal tube. As the flow changed periodically from laminar to turbulent, the fluctuating elocity of the jet flowing from the tube could be observed by noting the varying horizontal travel f the free jet along its parabolic trajectory. The probability, x, of the instantaneous occurrence of ully developed turbulent conditions is computed. It was found that turbulent and laminar flow ecame equally frequent ($x = 0.5$) at a Reynolds number of 1165. *Subject Headings:* **1. Turbulence heory 2. Reynolds numbers. I. Pigford, R. L.**—*R. L. Pigford.*

4A–164 551.511:551.551:533.17

Squire, William (*Cornell, Aeronautical Lab. Inc., Buffalo, N. Y.*), **On Broszko's theory of urbulent flow.** *Journal of the Aeronautical Sciences*, Albany, N. Y., 18(7):502–503, July **1951.** g., 6 refs., 15 eqs. **DLC**—Attention is turned to a little known paper of Broszko which contains a ormulation of a theory of turbulent flow based upon additional relations between the mean variation nd the turbulent fluctuation. In spite of its deficiencies, Broszko's theory gives satisfactory esults for the mean velocity distribution. The theoretical results are compared with averaged xperimental results. *Subject Headings:* **1. Turbulence theory 2. Turbulent flow. I. Broszko, —.** —*A.A.*

4A–165 551.511

Stewart, R. W., **Triple velocity correlations in isotropic turbulence.** *Cambridge Philosophical ociety, Proceedings*, 47(Pt. 1):146–157, Jan. **1951.** 8 figs., table, 11 refs., 7 eqs. **MH-BH**—The riple velocity correlation in turbulence produced by inserting a square mesh grid near the end of a ind tunnel, has been measured for mesh Reynolds numbers of $R_m = 5300$, 21,200 and 42,400. At ne lowest Reynolds number the correlation was measured from 20 to 120m downstream, covering ll the initial periods of decay. The correlation was everywhere positive with a maximum where ouble correlation falls to 0.3. Theory and equipment described in detail. *Subject Headings:* . **Statistical theory of turbulence 2. Turbulence correlation functions.**—*From author's abstract.*

4A–166 551.551

*Stewart, R. W. and Townsend, A. A., **Similarity and self-preservation in isotropic turbulence.** *oyal Society of London, Philosophical Transactions, Ser. A., Mathematical and Physical Sciences*, 43(867):359–386, June 12, **1951.** 15 figs., tables, refs., eqs. **DWB**—An attempt to present the xperimental evidence for the various theories of similarity. Measurements of the velocity correlaon functions and of the energy spectrum function were made at Reynolds numbers between 2000 nd 100,000. The theoretical spectrum function $K^{-5/3}$ is nonexistent under laboratory conditions, e empirical form $K^{-a} \log K$ is proposed (K is wave number). The quasi-equilibrium during decay doubtful according to the authors. *Subject Headings:* **1. Turbulence statistics 2. Turbulence ieasurement.**—*A.A.*

4A–167 551.511 551.551

†Sutton, O. G., **Atmospheric turbulence and diffusion.** (In: **Compendium of Meteorology.** oston, American Meteorological Society, **1951.** p. 492–509. 80 refs., numerous eqs.) **MH-BH, WB**—A critical summary of the literature and remarks about remaining difficulties. After escribing the nature of turbulent flow, the mathematical treatment is developed and the constants , A, K, μ, ν, l defined. Statistical theories of turbulence (Taylor, Kolmogorov, etc.) are set out. he physical features of local, large scale and planetary turbulence as shown in fields of temperature, elocity, vapor pressure and momentum are summarized; wind profiles (including Ekman spiral), ariations of eddy conductivity and diffusivity and height variations of K are discussed. Research n small scale diffusion and evaporation problems is described. Richardson's criterion, effect of ensity gradient and problems of convection are discussed. (*Same item as* 3.5–12, May 1952, *IAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Atmospheric turbulence 3. Turulent diffusion 4. Evaporation theory.**—*C.E.P.B.*

4A–168 551.551:551.5

Takeda, K., **On the atmospheric turbulence, 2nd paper. On the generalized exponenti formula.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(7):233–245, July **1951.** figs 2 tables, refs., numerous eqs. In Japanese, English summary p. 243–245. **DWB**—Theoretic work following that of DEACON (1949), PASQUILL (1949), SUTTON (1949), CALDER (1939 and 194 and SHEPPARD (1947). The author disagrees with DEACON's idea that the roughness paramet (Z_0) is constant, considering that it varies with stability, and explains this on the grounds that wh the air is stable, the roughness elements such as trees, leaves, brush, etc. exert a smaller influence on a flow than under unstable conditions. PASQUILL's values for $K/z^2 \frac{\partial u}{\partial z}$ are compared tabularly with t author's values. (*Same item as* 3.8–126, Aug. 1952, *MAB.*) *Subject Headings:* **1. Turbulen theory 2. Atmospheric turbulence 3. Roughness parameters. I. Deacon, E. L. II. Pasquill, III. Sutton, O. G. IV. Calder, K. L. V. Sheppard, P. S.**—*M.R.*

4A–169 551.551:533.

Townsend, A. A., **On the fine-scale structure of turbulence.** *Royal Society of London, Proce ings*, 208:534–542, **1951.** 3 figs., 7 refs., 13 eqs. **DWB**—Author discusses a comparison of expe mental studies of isotropic turbulence with current theories of turbulent energy transfer and deca He suggests that motion due to small scale turbulence "is essentially a random distribution of vort sheets and lines, in which the vorticity distribution is effectively stationary in time, due to balan between the opposing effects of vorticity diffusion by molecular viscosity, and vorticity productio and convection by the turbulent shear." (*Same item as* 3.3–155, March 1952, *MAB.*) *Subj Headings:* **1. Turbulence theory 2. Viscosity.**—*From author's abstract.*

4A–170 551.5

Townsend, A. A. (*Emmanuel Col., Cambridge*), **The passage of turbulence through wire gauze** *Quarterly Journal of Mechanics and Applied Mathematics*, Oxford, 4(3):308 320, Sept. **1951.** 9 fig 9 refs. **DWB**—It is usual to place woven-wire gauzes in the settling-lengths of wind tunnels wi the object of reducing the spatial variations of mean velocity fluctuations. The correspondi theory was elaborated by L. PRANDTL, and A. R. COLLAR and in 1949 a more general theory w given by G. I. TAYLOR and G. K. BATCHELOR (*Quart. J. Mech. and App. Math.*, 2:1–29, 194 Different authors found a poor agreement of this theory with experiments, but the measurements the author with a more comprehensive set agree very well with the theoretical predictions, exce that the degree of anisotropy is less than predicted. *Subject Headings:* **1. Wind tunnel experimen 2. Turbulence statistics.**—*A.A.*

4A–171 532.517.4 551.5

Townsend, A. A., **The structure of the turbulent boundary layer.** *Cambridge Philosophi Society, Proceedings*, 47(2):375–395, April **1951.** 12 figs., 13 refs., 8 eqs. **DWB**—After a discussi of new ideas in the theory of turbulence, experiments are described in a small wind tunnel. "It concluded that, most probably in contact with the laminar sub-layer, there must be a 'dissipati layer' within which most of the turbulent energy dissipation takes place, and that the bulk of the e dies are, in a sense, attached to the wall and have very high rates of shear in that region." Eddi are very elongated in the direction of the mean stream. (*Same item as* 3.2–122, Feb. 1952, *MA Subject Headings:* **1. Turbulence theory 2. Turbulence decay 3. Wind tunnel experiments.** *C.E.P.B.*

4A–172 551.508.54:551.5

†van der Hegge Zijnen, B. G. (*Delft*), **On the construction of hot-wire anemometers for t investigation of turbulence.** *Applied Scientific Research*, The Hague, A2(5/6):351–363, 195 7 figs., table, 11 refs. **DWB**—Description of hot wire anemometers in general, requirements f turbulence investigations, quality and characteristics of the wire, the supports, mounting, tensio frequency of wire and support, comparison of 7 types used in various countries and finally, a fu description and illustration of the "Delft" anemometer, including equipment for spot welding t wire to supports. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.** *M.R.*

4A–173 551.551:533.

Van Isacker, J., **Contribution à l'étude des fluides incompressibles en mouvement turbule** [Contribution to the study of incompressible fluids in turbulent movement.] *Belgium. Insti Royal Météorologique, Mémoires*, v. 43, **1951.** 44 p. 3 figs., tables, 13 refs., 110 eqs. **MH-BH** A discussion of the various theories of turbulence with an attempt at a synthesis. Chap. 1 sets o the general equations and defines concepts of mixing length, energy of turbulence and spectrum

turbulence. Chap. 2 deals with the flow of incompressible fluids in pipes and Chap. 3 introduces the problem of flow over rough surfaces. (*Same item as* 3.5–221, May 1952, *MAB.*) *Subject Headings:* **1. Turbulent flow 2. Turbulence theory.**—*C.E.P.B.*

4A–174 551.551

von Kármán, Theodor and Lin, C. C., **On the statistical theory of isotropic turbulence.** *Advances in Applied Mechanics*, N. Y., 2:1–19, **1951.** fig., table, 17 refs., eqs. **DLC**—Discusses the law of decay in a natural (infinite) field of turbulence, distinguishing between the early, intermediate and final stage. The similarity of the spectrum during the process of decay or the self-preservation of the correlation functions can be interpreted only with certain restrictions. The relation between correlation and spectral theories is shown. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence decay.**—*A.A.*

4A–175 551.511 551.551

†Yih, C. S., **A comparative study of momentum transfer, heat transfer, and vapor transfer, Part II.** Colorado. Agricultural and Mechanical College. Dept. of Civil Engineering, Contract N9onr-824-01, NR 063-071/1-19-49, Report No. 2, June **1951.** 131 p. 4 figs., 2 tables, 207 refs., 131 eqs. **DWB**—Report consists of an extensive review of existing literature in the field, prepared as a preliminary study in connection with the ONR Wind-tunnel Project to be carried out by the Colorado Agricultural and Mechanical College. Chap. I on theories of turbulence (transfer and statistical) includes review of the work of PRANDTL, TAYLOR, VON KÁRMÁN, BURGERS and REICHARDT. In Chap. II, Reynolds' analogy and its extensions by PRANDTL and TAYLOR, VON KÁRMÁN, HOFMANN and MATTIOLI are discussed. Specific problems in turbulent flow including roughness, boundary-layer theory and free turbulent jets and wakes are covered in Chap. III. In Chap. IV on mass transfer in the atmosphere, Sutton's theory, its modifications by PASQUILL, and FROST's theory are reviewed. Extensive bibliography included. *Subject Headings:* **1. Turbulence theory 2. Turbulent exchange. I. Colorado. Agricultural and Mechanical College, Dept. of Civil Engineering II. Contract N9onr-824-01, NR 063-071/1-19-49.**—*M.P.K.*

1952

4A–176 551.511:551.551

†*Badgley, Franklin I., **The measurement and statistical interpretation of some small scale turbulent air motions.** *New York University. College of Engineering, Meteorological Papers*, 1(6), Jan. **1952.** 40 p. 6 figs., 5 tables, eqs., bibliog. p. 36–39. **DWB**—Old methods for making instantaneous point measurements of velocity in turbulent fluids are reviewed and found deficient. Results presented of laboratory investigations using a new method include data from mean velocities, eddy velocities, eddy stresses, eddy energy, and the rate of dissipation of energy of mean motion through the mechanism of eddy motion. Statistical significance of results tested and found high for simpler, low for more complicated results. *Subject Heading:* **1. Turbulence measurement.**—*From author's abstract.*

4A–177 551.551

Batchelor, G. K., **The theory of homogeneous turbulence.** Cambridge, University Press, [1952?] Unchecked.—This monograph which is to appear soon is a full account of the mathematical and physical developments that are related, directly or indirectly, to homogeneous turbulence. *Subject Heading:* **1. Turbulence theory.**—*M.P.K.*

4A–178 551.511:551.551

Batchelor, G. K., **Turbulent motion.** *Physical Society of London, Reports on Progress in Physics*, 15:101–141, **1952.** 12 figs., eqs., bibliog. p. 140–141. Appendix: A. A. Townsend, **Advances in measuring technique. DWB**—A non-mathematical review of recent advances in study of turbulent motion. Considerable space is devoted to the theory of the universal equilibrium of the small-scale components and to experimental evidence and applications of that theory. "A section is devoted to the effect of turbulent convection on the distribution of various local properties of the fluid. The recent work on the study of homogeneous decaying turbulence is summarized, and the problem of turbulent shear-flow is considered." *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent flow 3. Turbulence decay. I. Townsend, A. A.**—*M.P.K.*

4A–179 551.511:551.551

Chandrasekhar, S., **On turbulence caused by thermal instability.** *Royal Society of London, Philosophical Transactions, Ser. A*, 244(884):357–384, March 11, **1952.** 3 tables, 24 refs., 226 eqs. **DWB**—A statistical theory of turbulence caused by the joint effects of gravity and thermal instability is developed. Restriction to a portion of the fluid far from the bounding surfaces permits treatment

as approximately homogeneous and axisymmetric. A fundamental set of solutions governing stationary turbulence is obtained, varying periodically in the vertical. These show that eddies have a minimum wave-length depending on the physical parameters and the temperature gradient. The field of turbulence can be analyzed into two modes characterized by the kinetic energy being confined principally to the vertical or horizontal direction. (*Same item* as 3.8–82, Aug. 1952, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Thermal instability.**—*From author's abstract.*

4A–180 551.551:551.508.54

Corrsin, Stanley, **Patterns of chaos.** *Johns Hopkins Magazine*, 3(4):10–14, 30–32, Jan. **1952.** 13 photos. **DLC**—Popular account of theoretical and practical aspects of turbulence with photographs showing occurrences of laminar and turbulent motion in smoke and water. Statistical approach in investigating turbulence, use of electronic equipment (hot wire anemometers in particular) and Johns Hopkins University's achievements in the field are discussed. (*Same item as* 3.8–122, Aug. 1952, *MAB.*) *Subject Headings:* **1. Turbulence measurement 2. Turbulent flow 3. Hot wire anemometers 4. Johns Hopkins University.**—*G.T.*

4A–181 551.511

Frenkiel, François N., **On the statistical theory of turbulent diffusion.** *National Academy of Science, Washington, Proceedings*, 38(6):509–515, June **1952.** refs., 18 eqs. Review by A. A. Townsend in: *Applied Mechanics Reviews*, 5(11):478, Nov. **1952. DLC**—The turbulent diffusion from a continuously emitting point source moving at uniform mean velocity through the fluid is considered, with particular reference to the case of turbulent velocities of the same order of magnitude as the mean velocity. Assuming the turbulence to be homogeneous, isotropic, and nondecaying, an expression for the distribution of mean concentration is developed in terms of the single-particle Lagrangian correlation function introduced by G. I. TAYLOR. Simpler approximate forms are also given which are suitable for long and short diffusion times. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion. I. Townsend, A. A.**—*A. A. Townsend.*

4A–182 551.508.54:551.511

Inoue, Ei-ichi, **Influences of the length of hot-wire anemometer on the measurement of turbulent flow.** *Physical Society of Japan, Journal*, 7(5):508–510, Sept./Oct. **1952.** 10 refs., 14 eqs. **DWB**—Using information on the fine structure of turbulence derived from the modern similarity theory, influences of hot-wire length or instrumental sensitivity on measurement of G. I. Taylor's smallest eddy in a turbulent fluid are dealt with theoretically. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*Author's abstract.*

4A–183 551.551

Knighting, E., **Random motion and atmospheric turbulence.** *Great Britain. Meteorological Research Committee, M.R.P.*, 728, April 16, **1952.** 8 p. ref., 33 eqs. Mimeographed. **DAWS**—The turbulent motion of marked particles from a point source is compared to random walks of a cluster. As the cluster spreads, larger eddies take effect and the steps are made with increasing velocities. Mathematical discussion leads to the conclusion that turbulence is characterized by this "law of step size." (*Same item as* 3.11–150, Nov. 1952, *MAB.*) *Subject Heading:* **1. Statistical theory of turbulence.**—*C.E.P.B.*

4A–184 551.511:551.551

Krzywoblocki, M. Z. E., **On the invariants in the turbulence in compressible viscous fluids.** *Franklin Institute, Journal*, Philadelphia, 254(4):317–322, Oct. **1952.** 3 refs., eqs. **DWB**—Starting with his own fundamental "generalized" equations for the propagation of the velocity and temperature correlation functions the author derives some moments in a homogeneous, isotropic turbulent flow of a compressible viscous fluid. *Subject Heading:* **1. Statistical theory of turbulence.**—*M.P.K.*

4A–185 551.551

Lauwerier, H. A., **A linear random walk with a partly reflecting partly absorbing barrier.** *Applied Scientific Research, B*, 2(4):294–300, **1952.** 29 eqs. **DLC**—Author first considers probability that a particle, which can be displaced by equal steps in either direction along a straight line, will arrive at a point z after n displacements. This gives solutions of the diffusion equation. He then considers the modifications introduced by a barrier at which the particle can be either absorbed or reflected. *Subject Headings:* **1. Turbulent diffusion 2. Statistical theory of turbulence.**—*C.E.P.B.*

4A–186 551.551 533.6

†Liepmann, Hans W., **Aspects of the turbulence problem. Survey report. First Part.** *Zeitschrift für angewandte Mathematik und Physik*, 3(5):321–342, **1952.** 33 refs., 75 eqs. **DLC**—This

mathematical paper surveys some general problems of turbulence not usually discussed. The theory of stationary stochastic processes (random processes independent of the time origin) introduces the concepts of autocorrelation and probability distribution. Sec. III deals with effects on linear systems on which turbulent fluctuations act as an impressed force. Typical examples discussed are the hot wire anemometer, the effect of turbulence on the propagation of light and sound waves (optical measurement of turbulence; turbulent noise), on the motion of solid bodies (raindrops, airplanes) and on a magnetic field. Many recent papers are referred to. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulence spectrum 3. Hot wire anemometers.**—*C.E.P.B.*

4A–187 551.551

Moyal, J. E., **The spectra of turbulence in a compressible fluid, eddy turbulence and random noise.** *Cambridge Philosophical Society. Proceedings*, 48(2):329–344. April **1952.** 15 refs., 63 eqs. **DWB**—In this mathematical study, turbulent motion is separated into fluctuating eddy motion (usually called turbulence) and fluctuating compression waves (random noise). These are analyzed by space Fourier spectra. They interact only through inertia effects at high levels of turbulence and large Reynolds numbers. The results are compared with those for an incompressible fluid and it is considered that "the main effect of compressibility on eddy turbulence is an additional source of energy dissipation through the creation of disordered acoustical waves which are transmitted or absorbed at the boundaries." *Subject Headings:* **1. Turbulence spectrum 2. Statistical theory of turbulence.**—*C.E.P.B.*

4A–188 551.511

Munk, Max. **Mechanism of turbulent fluid motion.** *Aero-Digest*, 64(4):32–34. June **1952.** 4 figs. **DLC**—The author severely criticizes the existing theories of turbulence and tries to give an explanation of the origin and maintenance of turbulent motion using a phenomenological approach. It is shown that vortex rings are oriented in prevailing directions in certain regions. Larger vortex rings are created by axial merging. These in turn break into smaller vortices, forming in such a way a cycle of creation and decay. No mathematical derivations are given. *Subject Headings:* **1. Turbulence theory 2. Origin of turbulence.**—*A.A.*

4A–189 551.551

Ogura, Y. (*Tokyo*), **The structure of two-dimensionally isotropic turbulence.** *Meteorological Society of Japan. Journal, 2nd Ser.*, 30(2):59–64. Feb. **1952.** 3 figs., 6 refs., eqs. **MH-BH**—Considering that many atmospheric phenomena can well be regarded to be nearly two-dimensional, the author theoretically deals with the two-dimensionally isotropic turbulent field. The structure of the field is investigated in close connection with that of the three-dimensionally isotropic turbulent field. The Taylor-Kármán correlation coefficient for the former is found to be approximately the same as that for the latter in numerical value, though its functional form is considerably different. The calculated numerical values of the coefficient agree well with actual observations in the atmosphere. *Subject Headings:* **1. Statistical theory of turbulence 2. Isotropic turbulence.**—*Author's abstract.*

4A–190 551.508.41:551.551:016

†Romano, J. E. and Kivnick, Arnold (*Illinois Univ.*). **Bibliography on hot-wire anemometry.** Prepared for issue in conjunction with Illinois. University. Contract N6-ori-71. Task Order No. XI, Quarterly Status Report No. 23 "Mixing of Fluid Streams." [**1952?**] 5 p. 65 refs. **DLC**—An unannotated bibliography of 65 references in English, German and French. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers 3. Bibliographies. I. Illinois. University II. Contract N6-ori-71.**—*M.P.K.*

4A–191 551.511:551.551

Truckenbrodt, E. (*Technical Univ., Braunschweig, Germany*), **An approximate method for the calculation of the laminar and turbulent boundary layer by simple quadrature for two-dimensional and axially symmetric flow.** *Journal of the Aeronautical Sciences*, 19(6):428–429. June **1952.** 2 figs., 10 refs., 8 eqs. **DLC**—"The method consists of calculating the momentum thickness and a shape parameter of the velocity profile which determines the point of separation. Both are calculated by simple quadrature." Further details to be published later. *Subject Heading:* **1. Boundary layer.**—*M.P.K.*

4A–192 551.511:551.551

Van Driest, E. R., **Investigating of laminar boundary-layer in compressible fluids using the Crocco method.** *U. S. NACA, Technical Note*, No. 2597, Jan. **1952.** 78 p. 51 figs., 3 tables, 4 refs., 58 eqs., append. Review by E. R. G. Eckert in: *Applied Mechanics Reviews*, 5(10):437. Oct. **1952.** **DLC**—Assuming a Prandtl number of 0.75 and constant specific heat and using the

Sutherland viscosity law, the Crocco method was used to solve the simultaneous differential equations of momentum and energy involved in the flow of air in a thin laminar boundary layer on a a flat plate. Results presented for skin friction and heat transfer coefficients as functions of Reynolds number, Mach number, and wall-to-stream temperature ratio. Variations of shear, velocity, temperature, and Mach number across the boundary layer are included. *Subject Headings:* **1. Turbulence theory 2. Boundary layer. I. Eckert, E. R. G.** *-From author's summary.*

4A–193 551.511:551.551

*Young, George B. W. and Janssen, Earl (*Univ. of Cal. and Rand Corp.*), **The compressible boundary layer.** *Journal of the Aeronautical Sciences*, 19(4):229–236, 288, April **1952.** 21 figs., 7 tables, 19 refs., eqs., append. **MH-BH**—"The laminar boundary-layer equations in integral form as obtained by MOORE are solved on the mechanical differential analyzer. From the results, an approximate design procedure for the calculation of the characteristics of both the laminar and turbulent boundary layers is obtained and presented as an aid to missile designers." A brief discussion of air properties as a function of temperature is appended. *Subject Headings:* **1. Boundary layer 2. Turbulence theory.**—*M.P.K.*

1953

4A–194 531/534:551.5:016(05)

Applied Mechanics Reviews; A Critical Review of the World Literature in Applied Mechanics and Related Engineering Science. Publ. by American Society of Mechanical Engineers, Easton, Penna. First issue v. 1, No. 1, Jan. **1948.** Latest issue received, v. 6, No. 1, Jan. **1953. DWB**—Now in its sixth year, this monthly periodical has proven one of the best sources of critical abstracts in many fields of interest to the technical or theoretical meteorologist. Of special interest are the reviews on aerodynamic turbulence, dynamic meteorology, oceanography and geophysics. The last named section contains reviews of articles on atmospheric turbulence. Each review is written by an authority on the particular subject regardless of what part of the world he lives in. (For fuller abstract *see item* 2.6–4, June 1951, *MAB.*) *Subject Headings:* **1. Applied mechanics 2. Turbulence 3. Reviews 4. Periodicals. I. Goland, Martin** (*ed.*) **II. American Society of Mechanical Engineers.**—*M.R.*

SUPPLEMENTARY MATERIAL

4A–195 532.54

Darcy, H., **Recherches expérimentales relatives au mouvement de l'eau dans les tuyaux.** [Experimental research relative to the movement of water in pipes.] *Académie des Sciences, Paris, Mémoires par Divers Savants*, 5:141–403, **1858.** tables, eqs. **DLC**—An extensive and classical memoir on the relation between diameter, length and speed of flow of water in pipes, beginning with a chapter on the reason for the investigations, the apparatus employed in the studies, the results of experiments, the calculation of coefficients, the formulation of the law for movement through channels, and the effect of resistance. DARCY attempted to explain why the amount of water flowing through a pipe is 20 or 30 times smaller than would be assumed from the then known laws of motion, and deduced that the effect of friction was transferred by some mechanism throughout the diameter of the pipe, according to a law which was a combination of the first and second power of the speed, but for high speeds followed the second power (square) of speed. Extensive tables are given to show the values for various l, d and v. *Subject Headings:* **1. Turbulent flow 2. Frictional effects.**—*M.R.*

4A–196 551.508.54:551.551

King, Louis Vessot, **On the precision measurement of air velocity by means of the linear hot-wire anemometer.** *London, Edinburgh and Dublin Philosophical Magazine*, 29(172):556–577, April **1915.** 4 figs., 2 tables, refs., 16 eqs. **DLC**—Specifications for construction of a linear hot wire anemometer are given in this comprehensive report. (The first attempt at constructing a hot wire anemometer was made in Birmingham, England in 1902 by G. A. SHAKESPEAR, but observations were confined to the free atmosphere and the project was abandoned because of lack of any whirling table or other calibrating device.) Selection of the platinum wire and calibration, accuracy and sensitivity of the wire, the effect of atmosphere conditions (pressure, humidity and temperature variations), life of wires and, finally, application of hot wire anemometer to measurement of rapid variations in wind speed in the laboratory, are all treated. It was stated that the use of the hot wire makes the instrument independent of exterior variations in temperature. Thousands of observations were made before preparing this report. The upper and lower limits of correct velocity registration, sources of error and directions for using the device are given in detail. The anemometer measured velocities as low as 15 cm/sec with an accuracy of about 10%. The highest

peeds tested were 2800 cm/sec (62 m.p.h.), and it was thought that even higher speeds could be neasured with shorter or stouter wire. *Subject Headings:* **1. Hot wire anemometers 2. Turbulence neasurement.**—*M.R.*

4A–197 551.508.54:551.551

Taylor, C. Fayette, **A suggested method for measuring turbulence.** *U. S. NACA, Technical Vote*, No. 380, **1931.** 7 p. 4 figs., 8 refs. **DLC, DWB**—Suggests two hot wires, one at right ngles and one parallel to air flow for measuring amplitude and intensity of turbulence. Equipment lesigned at M.I.T. described and illustrated, and calibration shown. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers.**—*M.R.*

4A–198 551.551:551.511

Dryden, Hugh L., **Turbulence and boundary layer.** *Journal of the Aeronautical Sciences*, 5(3):85–100, Jan. **1939.** 13 figs., 44 refs. **DLC**—In this paper, which is the published version of the Second Wright Brothers Lecture read by the author Dec. 17, 1938, the results of ten years of wind tunnel experiments at the National Bureau of Standards are summarized. (The first wind tunnel, incidentally, was constructed in 1871 by H. WENHAM; PRANDTL built one in 1908.) The oncept of turbulence is clearly outlined, oscillograms, hot wire anemometers, etc. are discussed and illustrated. Boundary layer problems and effects of turbulence are reviewed and, finally, atmospheric turbulence, which the author states is nearly zero, is discussed from the aerodynamicists oint of view. *Subject Headings:* **1. Turbulence theory 2. Wind tunnel experiments 3. Boundary ayer.**—*M.R.*

4A–199 551.551:551.573

Brookfield, K. J., Fitzpatrick, H. D. N., Jackson, J. F., Matthews, J. B. and Moelwyn-Hughes, E. A., **The escape of molecules from a plane surface into a still atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 190:59–67, **1947.** 3 figs., 6 tables, 9 refs., 26 eqs. **DLC**—Highly heoretical work in which a theory is advanced embracing diffusion conditions formulated by MAXWELL (1890) and vacuum conditions of KNUDSEN (1915), and cast in such a form as to make accessible o experiment the determination of coefficients of diffusion and accommodation by novel means. Experimental determination of coefficient of diffusion of water vapor in air made. Reliable values of the coefficient of accommodation may be developed by this method. (*Same item as* K–145, Nov. 950, *MAB.*) *Subject Headings:* **1. Evaporation 2. Turbulent diffusion.**—*H.P.K.*

4A–200 551.51:533.15

Batchelor, G. K., **The effect of homogeneous turbulence on material lines and surfaces.** *Royal Society of London, Proceedings, Ser. A*, 213(1114):349–366, July 8, **1952.** 5 refs., 55 eqs. **DLC**—A mathematical study of the tendency of neighboring particles to separate through turbulence and ience on the distortion of lines or thin sheets consisting always of the same fluid particles. This is pplied to the distribution of mass density (e.g. some foreign substance per unit mass of fluid) and lux of vector quantities (e.g. vorticity). The effect of large differences between values of molecular diffusion and vorticity is discussed. *Subject Heading:* **1. Turbulent diffusion.**—*C.E.P.B.*

4A–201 551.551:551.573

Davies, D. R. and Walters, T. S., **Further experiments on evaporation from small, saturated, lane areas into a turbulent boundary layer.** *Physical Society of London, Proceedings, Ser. B*, 65(392):640–645, Aug. 1, **1952.** 3 figs., table, 4 refs., 3 eqs. **DWB**—For the first investigation *ee item* 3.5–227, May 1952, *MAB.* Experiments are now extended to lengths up to 15 in. and vidths to 6 in. The setup is described and results tabulated and plotted. Evaporation is found o be proportional to $(\text{length})^{0.76}$ and to $(\text{width})^{0.84-.86}$, compared with a theoretical power (after O. G. Sutton) of 0.88. The experimental values exceed those given by authors' 1951 formula by only 4%. *Subject Headings:* **1. Evaporation theory 2. Turbulence.**—*C.E.P.B.*

4A–202 551.573:551.551

Gandin, L. S. and Soloveĭchik, P. E., **K teorii ispareniia s ogranichennykh vodoemov.** [Theory of evaporation from limited water containers.] *Akademiia Nauk, SSSR, Doklady*, 86(1):55–57, Sept. 1, **1952.** 5 refs., 4 eqs. **DLC**—The authors give the integral $q(x, y, z)$ for the differential quation

$$u\frac{\partial q}{\partial x} = k_x\frac{\partial^2 q}{\partial x^2} + k_y\frac{\partial^2 q}{\partial y^2} + \frac{\partial}{\partial z}\left(k_z\frac{\partial q}{\partial z}\right)$$

—specific humidity; u—wind velocity; k_x, k_y—coefficients of horizontal exchange; k_z—vertical xchange coefficient; x—axis in the wind direction. For the exchange coefficient k, both horizontal nd vertical, power functions are assumed, as well as for the wind velocity. Border conditions: a

given distribution $q_{z=0} = F(x, y)$ and limited q in the indefinity for each direction. The solution for the distribution of specific humidity in space for a limited water surface in this very general case is a complicated combination of Bessel and Γ functions. *Subject Headings:* **1. Evaporation theory 2. Turbulent exchange.**—*A.A.*

4A–203 551.551.1 533.6

†Liepmann, Hans W., **Aspects of the turbulence problem. Second part.** *Zeitschrift für angewandte Mathematik und Physik*, 3(6):407–426, **1952.** 74 refs., 45 eqs. German summary p. 426. **DLC**—Pt. 2 begins with a survey of the literature of turbulent transport and discusses mathematical models, local isotropy and secondary large-scale structure in turbulent shear flow. The paper ends with a summary of results and problems of the theory of isotropic turbulence (functions, equations of motion, decay and self-preservation, exchange term and fluctuations of temperature and pressure). *Subject Heading:* **1. Turbulence theory.**—*C.E.P.B.*

4A–204 551.551:533.6:001

Aerodynamic numbers. *Meteorological Magazine*, London, 81(966):369–375, Dec. **1952.** 3 figs., 10 refs. **DWB**—Notes on Mach, Reynolds and Richardson numbers, description of machmeter and applications to flying and meteorology. *Subject Headings:* **1. Aerodynamics 2. Definitions 3. Turbulence theory.**—*C.E.P.B.*

4A–205 551.511:532(02)

Prandtl, Ludwig, **Essentials of fluid dynamics. With applications to hydraulics, aeronautics, meteorology and other subjects.** London, Glasgow, Blackie and Son, Ltd., **1952.** 10+452 p. Price 35s.—Authorized translation of "Führer durch die Strömungslehre" 1949 ed. For the original *see* 4A–123 above. *Subject Headings:* **1. Turbulence theory 2. Fluid mechanics 3. Mechanics of the atmosphere 4. Textbooks. I. Volpert, G. A.** (*trans.*).

PART III. METEOROLOGICAL ARTICLES APPEARING IN RECENTLY ISSUED PUBLICATIONS

Note: The contents of periodicals included in this section, are for information only, and will not be listed in the monthly indexes. When material is furnished in advance of date of publication, the pagination may be omitted.

Akademiia Nauk SSSR, Izvestiia, Ser. Geofizicheskaia, Leningrad, No. 4, 1952.

Turlygin, S. IA. and Karelina, N. A.: **Vliianie sushi i moria na raspredelenie prirodnykh elektricheskikh tokov po poverkhnosti zemli,** [Influence of continent and sea on distribution of natural electric currents on the earth's surface], p. 55–75.

Monin, A. S.: **Izmeneniia davleniia v barotropnoĭ atmosfere,** [Change of pressure in barotropic atmosphere], p. 76–85.

Bugaev, V. A.: **O poriadke velichin gorizontal'nykh proizvodnykh baricheskogo i temperaturnogo poleĭ atmosfery,** [On the order of magnitude of horizontal derivatives of baric and temperature fields of the atmosphere], p. 86–97.

Vitel's, L. A.: **Kalendarnye osobennosti v kolebaniiakh intensivnosti islandskikh i severoevropeĭskikh tsiklonov,** [Calendar of singularities in fluctuations in the intensity of Icelandic and north European cyclones], p. 97–102.

Akademiia Nauk SSSR, Izvestiia, Ser. Geofizicheskaia, No. 5, 1952.

SHtokman, V. B.: **Primenenie metoda polnykh potokov dlia rascheta tsirkuliatsii, vozbuzhdaemoĭ neravnomernym vetrom v more ellipticheskoĭ formy,** [Application of the method of full currents for calculations of circulation induced by irregular wind in a sea of elliptical form], p. 57–68.

Kondrat'ev, K. IA.: **O zavisimosti pogloshcheniia dlinnovolnovoĭ radiatsii v atmosfere ot temperatury i davleniia,** [Dependence of absorption of long wave radiation in the atmosphere on temperature and pressure], p. 69–75.

Krylov, P. A.: **K voprosu o sukhoveiakh v Povolzh'e,** [The problem of dry winds in the Volga Region], p. 76–85.

Krasnogorskaia, N. V.: **Elektronnyĭ umnozhatel' kak pribor dlia izmereniia razmerov chastits osadkov,** [Electronic amplifier as an instrument for measuring the size of precipitation particles], p. 86–91.

Angewandte Meteorologie, Berlin, Volume 1, Number 6, June 1952.

Flach, Emil and Würfel, H.: **Zur Kenntnis der lufthygienischen Eigenschaften Berlins und seiner Randgebiete,** [On the hygienic characteristics of the air of Berlin and neighborhood], p. 161–169.

Spangenberg, W. W.: **Geruchempfindungen in Abhängigkeit von atmosphärischen Vorgängen,** [Sensitivity to odors in dependence on atmospheric processes], p. 170–172.

Zenker, H.: **Über den Bodenfrost in Halle/Saale 1911- bis 1935,** [Soil freezing in Halle/Saale 1911–1935], p. 172–180.

Schrödter, H.: **Der Einfluss der Temperatur auf das Auftreten und die Entwicklung des Mohnkapselrüsslers.** [The influence of temperature on the emergence and development of the poppy-beetle], p. 180–184.

Schrödter, Harald: **Über die Bedeutung klimatischer Faktoren für das Rutensterben der Himbeeren.** [The significance of climatic factors in the death of raspberry vines], p. 184–189.

Flach, Emil: **Courvoisier, P.: Die Schwankungen des elektrischen Feldes in der Atmosphäre und ihre Bedeutung für die Meteoropathologie,** [Courvoisier, P.: The variations of the electric field in the atmosphere and its significance for meteoropathology], p. 190.

Flach, Emil: **Mörikofer, W.: Zur Meteorologie und Meteorobiologie des Alpenföhns,** [Mörikofer, W.: Meteorology and meteorobiology of Alpine föhns], p. 190–191.

Flach, Emil: **Lossnitzer, H.: Die Bedeutung des elektromagnetischen Erdfeldes in der Bioklimatologie,** [Lossnitzer, H.: Significance of the earth's electromagnetic field for bioclimatology], p. 191.

Angewandte Meteorologie, Berlin, Volume 1, Number 7, October 1952.

Wagner, H.: **Schwingungen im Verlauf der Körpertemperatur und ihre Kopplung mit föhnartigen Verhältnissen,** [Oscillations in body temperature and their relation to föhn-like conditions], p. 193–202.

Koch, Horst Günther: **Vergleichende Terminmessungen der Abkühlungsgrösse mit Katathermometern in Thüringen 1947–51,** [Comparative fixed measurements of the rate of cooling with katathermometers in Thüringia], p. 203–211.

Spangenberg, Wolf W.: **Untersuchungen zur Entstehung der Schwüle,** [Investigations into the origin of sultriness], p. 211–215.

Mäde, Alfred: **Zur Methodik mikroklimatischer Temperaturmessungen,** [On the technique of microclimatic temperature measurements], p. 215–219.

Böer, Wolfgang: **Einige Vorschläge zur praktischen Durchführung einer geländerklimatischen Aufnahme unter besonderer Berücksichtigung städtebaulicher Gesichtspunkte,** [Some proposals for a practical regional climatic survey especially from the point of view of town-planning], p. 219–222.

Regel, C.: **Zur Klimaänderung der Gegenwart,** [On the change of climate of the present time], p. 222.

Stepanow, W.: **Über die minimalen Temperaturen für die Samenkeimung und das Erscheinen der Triebe bei Feldkulturen,** [On the minimum temperatures necessary for seed germination and the appearance of shoots in field crops], p. 222–223.

Dawitaja, F. F.: **Richtung und Methoden der Agragmeteorologie in der USSR,** [Trends and methods of agricultural meteorology in the U.S.S.R.], p. 223.

Ertl, L.: **Über die Lichtverhältnisse in Laubflechten,** [On the light conditions in foliage], p. 223–224.

Slobodtschikow, D. D.: **Aufhalten des Schneewassers als wichtiges Mittel zur Steigerung der Feuchtigkeit und des Ertrages,** [Retention of snow water as an important means for the increase of moisture and yield], p. 224.

Götz, B.: **Der Einfluss der Tageszeit und Witterung auf Ausschlüpfen, Begattung und Eiablage des Springwurmwicklers Sparganothis pilleriana Schiff,** [Influence of time of day and weather on the eclosion, mating and oviposition of Sparganothis pilleriana Schiff], p. 224.

Archiv für Meteorologie, Geophysik und Bioklimatologie, Serie A, Vienna, Volume 5, Number 2, 1952.

Arakawa, H.: **Zonal wind-profile between the pole and the equator given by a single expression,** p. 129–135.

James, R. W.: **Some remarks on the thermodynamics of cyclones and anticyclones,** p. 136–157.

Ehrenberg, W. W.: **Beitrag zum Problem der Eisbildung in Wasserwolken,** [Contribution to the problem of ice formation in water clouds], p. 158–165.

Jacobi, W., Junge, Christian, and Lippert, W.: **Reihenuntersuchungen des natürlichen Aerosols mittels Elektronenmikroskops,** [Serial investigations of natural aerosols by the electron microscope], p. 166–178.

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